Draft
Supplemental Environmental Impact Statement

Maury Island Aquatic Reserve

Lead Agency: Washington State Department of Natural Resources
Aquatic Resources Program

July 13, 2004

WASHINGTON STATE DEPARTMENT OF
Natural Resources
Doug Sutherland - Commissioner of Public Lands

Page Intentionally Blank

WASHINGTON STATE DEPARTMENT OF
Natural Resources

DOUG SUTHERLAND
Commissioner of Public Lands

July 13, 2004

Dear Interested Stakeholder:

In compliance with the State Environmental Policy Act (SEPA), the Washington State Department of Natural Resources (WDNR) has developed this Draft Supplemental Environmental Impact Statement (DSEIS) for the proposed Maury Island Aquatic Reserve Management Plan. The proposed action would establish a management strategy for the Maury Island site, which includes Quartermaster Harbor and the eastern shoreline of Maury Island. The DSEIS is available on the WDNR website: www.dnr.wa.gov.

The DSEIS analyzes reasonable alternatives for managing the state-owned aquatic lands at the site, the probable significant adverse and beneficial environmental impacts of the alternatives, and their relation to existing policies, rules, and regulations.

We encourage the public to review the DSEIS and management plan, attend the August 10 public hearing, and submit any written comments by August 27, 2004.

If you have any questions or need assistance, please contact David Palazzi, Environmental Planner, WDNR's Aquatic Resources Division, at (360) 902-1069 or david.palazzi@wadnr.gov.

Sincerely,

Francea L. McNair,
Aquatic Lands Steward

1111 WASHINGTON ST SE ▮ PO BOX 47001 ▮ OLYMPIA, WA 98504-7001
TEL: (360) 902-1004 ▮ FAX: (360) 902-1775 ▮ TTY: (360) 902-1125
Equal Opportunity/Affirmative Action Employer

Fact sheet –

Project Title: Maury Island Aquatic Reserve Draft Supplemental Environmental Impact Statement (SEIS) for the Department of Natural Resources Aquatic Reserves Program

Project Description: The purpose of this action is to adopt and implement appropriate management strategies for state-owned aquatic lands at the Maury Island site, which includes Quartermaster Harbor and the eastern shoreline of Maury Island. Maury Island is in King County, Township 21 North, Range 02 East and 03 East, and Township 22 North, Range 02 East and 03 East. This non-project draft Supplemental Environmental Impact Statement, provides an opportunity for the public and private sector, affected Tribes, and agencies with jurisdiction, expertise, and interest to review and comment on the proposed action by the Washington State Department of Natural Resources (DNR) to implement appropriate management strategies for the Maury Island site. This document analyzes reasonable alternatives, the probable significant adverse and beneficial environmental impacts of the alternatives, and their relation to existing policies, rules and regulations.

The Aquatic Reserves Program Guidance Final Programmatic Environmental Impact Statement (FEIS) was issued on September 6, 2002 to define criteria for establishing an aquatic reserve. The Maury Island Aquatic Reserve SEIS implements the guidance. Copies of the programmatic FEIS are available for review through either the SEPA Center or the Aquatic Resources Division, Washington Department of Natural Resources, 1111 St. SE, Olympia, Washington, or the State Library.

The alternatives evaluated under this draft SEIS include:

Alternative 1 – Environmental Aquatic Reserve at the Maury Island Site. The preferred alternative is to establish boundaries for the Maury Island site and manage the area as an environmental aquatic reserve. This would include the development of the following site-specific components:

a. Management plan
b. Reserve boundary

Alternative 2 – No Reserve Status at the Maury Island Site. This alternative would repeal the existing reserve designation at the Maury Island site and return the state-owned aquatic lands to general leasing status.

Alternative 3 – No Action. This alternative would continue to manage the Maury Island site as a withdrawn area and aquatic reserve as established in 2000. Management of the area would be based on the general management strategies presented in the Non-Project Final Environmental Impact Statement (FEIS): Aquatic Reserve Program Guidance (DNR 2002).

Project Proponent: Washington Department of Natural Resources, Aquatic Resources Program.

Lead Agency: Washington Department of Natural Resources
Aquatic Resources Program
1111 Washington Street SE
P.O. Box 47027
Olympia, WA 98504-7027

Responsible Official: Loren Stern, Manager
Aquatic Resources Division
1111 Washington Street SE
P.O. Box 47027
Olympia, WA 98504-7027

Technical Contact Person: David Palazzi, Environmental Planner
Aquatic Resources Division
1111 Washington Street SE
P.O. Box 47027
Olympia, WA 98504-7027

SEPA Contact Person: Jenifer Gitchell
SEPA Center
1111 Washington Street SE
Olympia, WA 98504-7015
sepacenter@wadnr.gov

Licenses Required: Licenses are not required for this proposal.

Authors and Principal Contributors:
Principle Authors: David Palazzi, Marc Daily, Jay Udelhoven, and Philip Bloch
Contributors: Carol Cloen and Aquatic Region staff

Date of Issuance of Draft SEIS: July 13, 2004

Public Comment Deadline: August 27, 2004

Public Hearing: August 10, 2004 - 7:00 p.m. to 9:00 p.m.
McMurray Middle School, Multi-purpose room
9329 SW Cemetery Road - Vashon Island, WA 98070-6105

Proposed Date of Issuance of Final SEIS and Public Benefits Analysis: October 26, 2004

Proposed Final Action Date: November 2004

Subsequent Environmental Review: None anticipated

Location of Reference Material: Natural Resources Building - Olympia, Washington

Contacts:

Technical Questions:
David Palazzi
Aquatic Resources Program
1111 Washington Street, SE
P.O. Box 47027
Olympia, WA 98504-7027
360-902-1069

SEPA Questions:
Jenifer Gitchell
SEPA Center
1111 Washington Street, SE
P.O. Box 47015
Olympia, WA 98504-7015
360-902-1634 or SEPACenter@wadnr.gov

Availability:

Digital copies or CD-ROMs of the draft SEIS are available at the Washington Department of Natural Resources' web site at: http://www.dnr.wa.gov/htdocs/aqr/reserves/home.htm. Single copies and supporting documentation are available from the Department.

Hardcopies of the draft SEIS are provided free to the public until the initially printed copies run out. After that, charges will be assessed for the costs of copying. Free copies and color versions of the maps are also available on-line at: http://www.dnr.wa.gov/htdocs/aqr/reserves/home.htm

Table of Contents

Appendices

List of Acronyms

BMP - Best Management Practice

cfs - cubic feet per second

Corps - United States Army Corps of Engineers

CWA - Clean Water Act

DDT - Dichloro Diphenyl Trichloroethane

DNR - Washington Department of Natural Resources

DO - Dissolved Oxygen

Ecology - Washington Department of Ecology

EIS – Environmental Impact Statement

ESA – Endangered Species Act

ESU - Evolutionarily Significant Unit

FDA - Food and Drug Administration

FEIS – Final Environmental Impact Statement

HPA – Hydraulic Project Approval

IBA - Important Bird Area

NOAA-Fisheries - National Oceanic and Atmospheric Administration-Fisheries

NPDES – National Pollution Discharge Elimination System

PCBs - Polychlorinated Biphenyls

PSP - Paralytic Shellfish Poisoning

RCW – Revised Code of Washington

SEIS – Supplemental Environmental Impact Statement

SEPA – State Environmental Policy Act

TAC - Technical Advisory Committee

TMDL - Total Maximum Daily Load

USFWS - United States Fish and Wildlife Service

WAC – Washington Administrative Code

WDFW – Washington Department of Fish and Wildlife

WDOH – Washington Department of Health

1.0 Summary

The Washington Department of Natural Resources (DNR) is the steward for approximately 2.4 million acres of state-owned aquatic bedlands, tidelands, and shorelands. The DNR is charged with managing these lands for a balance of public benefits, as dictated by state statutes and rules. The state-owned aquatic lands of Quartermaster Harbor and the eastern shoreline of Maury Island support important biological and physical characteristics that may warrant specific management provisions.

The proposed action would establish a specific management strategy for the Maury Island site, which includes state-owned aquatic lands within Quartermaster Harbor and along the eastern shoreline of Maury Island. This document identifies three reasonable alternatives for implementing a management strategy and evaluates the probable significant adverse and beneficial environmental impacts of the alternatives.

1.1 Organization of the Supplemental Environmental Impact Statement

The document begins with an overview of the SEIS document as a whole (Section 1.0).

Section 2.0 of the document provides background information pertaining to DNR's aquatic reserve program, with an emphasis on planning that has occurred at the Maury Island site, to date. This section also discusses the purpose and need for the proposed action and briefly discusses the legislative authority and mandates that are driving this process.

Section 3.0 explains how DNR formulated the three action alternatives evaluated in this SEIS, including scoping that was conducted. The three alternatives identified and discussed include: the Preferred Alternative, Repeal the Reserve, and No Action. Sections 3.2 through 3.4 outline the objectives, specific management provisions, boundaries, and implementation procedures for each of the three alternatives.

Section 4.0 describes the existing conditions at the Maury Island site for the elements of the environment that may be impacted by the three action alternatives. The elements of the environment include: earth, air, water resources, plants and animals, energy and natural resources, environmental health, land and shoreline uses, transportation, and public services and utilities. Following the description of existing conditions, the potential environmental impacts of the alternatives are evaluated for each of these elements of the environment.

Section 5.0 evaluates the potential cumulative impacts that may result from each of the action alternatives, and Section 6.0 discusses mitigating activities for all three of the alternatives.

Section 7.0 details the distribution process for the document, while Section 8.0 includes the references for the SEIS. Appendix A provides a brief summary of comments received during the scoping process and how DNR considered these comments. The remaining appendices C through M include figures referenced in the SEIS, with Appendix N providing the complete distribution list for the document.

1.2 Proposed Action – Purpose, Objectives, and Need

The purpose of the proposed action is to establish an appropriate management framework for the state-owned aquatic lands within Quartermaster Harbor and along the eastern shoreline of Maury Island. The objective is to formalize specific management directives to provide for environmental protection. The need for this action arises from the nearshore habitat degradation that has occurred in the central Puget Sound basin and the fact that the Maury Island site represents one of the remaining areas in the basin that supports relatively high quality aquatic habitat and species assemblages (Williams et al. 2000).

1.3 Alternatives

Through scoping and research conducted by DNR staff, three action alternatives were identified and have been evaluated in the following SEIS. Alternative 1 (Preferred Alternative) identifies a proposed boundary that is approximately 336 acres smaller than the original reserve designation (5,530 acres) and proposes a site-specific draft management plan to direct DNR activities at the Maury Island Environmental Aquatic Reserve site.

Alternative 2 (Repeal the Reserve Alternative) would rescind the existing reserve designation for the Maury Island site and make the state-owned aquatic lands available for general leasing opportunities.

Alternative 3 (No Action Alternative) would maintain the existing environmental aquatic reserve designation for the area (5,866 acres) while future management would be guided by existing Revised Code of Washington (RCW), Washington Administrative Code (WAC), and the general management actions presented in the programmatic FEIS (DNR 2002).

An overview of the three action alternatives is provided in Table 1.

Table 1: Overview of Program Administration for the Three Alternatives

Management Elements	Alternative 1 (Preferred)	Alternative 2 (Repeal)	Alternative 3 (No Action)
Area included in the site (acres)	5,530	5,866 (removed from reserve designation)	5,866
Management Provisions	Site specific management provisions related to: existing uses, reauthorizations and new authorizations, including identifying areas of appropriate uses and specific design/operation requirements. Identifies DNR led and partnering activities to benefit reserve conditions and voluntary activities that could be undertaken on lands adjacent to the reserve.	Management of the site would be similar to other state-owned aquatic lands in accordance with existing RCWs and WACs.	Management of the site would be in accordance with existing RCWs, WACs, and general management actions presented in the final programmatic environmental impact statement (September 6, 2002).
Commissioner's Order	After completion of SEPA, a new Commissioner's Order would be issued, which would detail the decision made.	After completion of SEPA, a Commissioner's Order would be issued to rescind the aquatic reserve designation.	No new Commissioner's Order would be required under this alternative.
Program Implementation	Negotiated through use authorizations and through seeking cooperative relationships with other government entities, interest groups, and the local community. Emphasis would be on protection, preservation, and enhancement of the primary species and habitats identified in the management plan. The plan would be reviewed every 10 years.	No special implementation measures would be needed. Implementation would be through evaluation of use authorizations/ reauthorizations under existing RCWs and WACs. Emphasis would be on balancing the DNR mandates established in RCW 79.90.455.	Land managers would implement the program through evaluation of use authorizations/ reauthorizations based upon the RCWs, WACs, and the programmatic FEIS. Emphasis would be on protection, preservation, and enhancement of the site, although no site-specific management plan would guide this objective.

1.4 Affected Environment

The following provides a brief summary of the elements of the affected environment described and evaluated in the SEIS. Following the affected environment summaries, Table 2 provides a summary of the potential effects of the three action alternatives.

1.4.1 Earth

The Maury Island site is underlain by glacial till, sand, and gravel. Approximately 88 percent of the Vashon-Maury Island shoreline contains bluffs or banks. Erosion of these landforms is an integral process in maintaining sandy beaches in the area. The site

contains a number of nearshore drift cells[1], including a single, continuous cell along the eastern shoreline of Maury Island. Existing evidence suggests that few contaminants resulting from human activities are affecting aquatic sediments in the area.

1.4.2 Air

There is no recent site-specific air quality data available, although monitoring conducted in the late 1970s through the 1980s demonstrated that ambient air quality was within current standards. Between 1890 and 1985 air quality throughout the reserve area was negatively impacted by a copper and arsenic smelter located in Tacoma. Closure of the smelter in 1985 resulted in measurable declines in sulfates and arsenic as far away as the Canadian border (Faulkner 1987).

1.4.3 Water Resources

Quartermaster Harbor is a rather shallow embayment (generally 5 to 30 feet). Water quality in the harbor has been adversely impacted by human-induced activities, with existing data demonstrating that water in the area does not comply with state water quality standards relating to dissolved oxygen and dieldrin (an insecticide). Fecal coliform pollution and paralytic shellfish poisoning are also a concern in the harbor. No water quality information was found for the eastern shoreline of Maury Island.

The major freshwater inputs to Quartermaster Harbor include Judd and Fisher creeks, with a number of lower order streams and tideland seeps. Streams along the eastern shoreline of the island all have low or intermittent flows.

1.4.4 Plant and Animal Resources

Quartermaster Harbor and the eastern shoreline of Maury Island support a number of fish species including rearing and migrating Chinook, chum, and coho salmon and steelhead, cutthroat, and bull trout. Chinook salmon and bull trout are protected as threatened species under the Endangered Species Act. The Maury Island site also supports a relatively high abundance of forage fish such as herring, surf smelt, and sand lance. A variety of groundfish and rockfish species are also found in the area. Geoducks, crabs, and other macroinvertebrates are distributed throughout the Maury Island site.

One of the reasons for the abundance of fish and invertebrate life is the distribution of eelgrass and kelp throughout the site. These aquatic plant habitats provide food and refuge for many aquatic species. *Spartina*, an invasive aquatic plant species, has also been found in the area, but is not currently found at levels that substantially threaten habitat quality.

Marine mammals are not particularly abundant in the area, although river otters, harbor seals, California sea lions, and killer whales, may all periodically inhabit the Maury Island site.

[1] Drift cells are systems in which sediment is suspended by waves or currents and transported along the shoreline in a cycle of suspension and deposition.

The area is also considered an Important Bird Area by Audubon Washington, primarily due to a wintering western grebe population. Great blue heron, bald eagle, possibly marbled murrelet, and many other bird species, especially waterfowl, also inhabit the Maury Island site.

1.4.5 Energy and Natural Resources

There are several Puget Sound Energy utility easements along the northeastern shoreline of Maury Island, which provide electricity and natural gas to Vashon and Maury islands. In addition, commercial and recreational geoduck harvest occurs in many locations of the Maury Island site. Harvest of other shellfish (e.g., hardshell clams), herring, and smelt also occurs in the area.

1.4.6 Environmental Health

Industrial use of the eastern shoreline of Maury Island poses a potential threat to environmental health in the form of noise, hazardous spills, and/or material spills. Docks and marinas in the area may also introduce creosote, waste, fuels, and/or hydraulic fluids. Residential septic systems and stormwater outfalls may impact water and sediment quality.

1.4.7 Land and Shoreline Use

King County comprehensive and shoreline plans dictate uses in the area, which are predominantly rural residential. Development in the area has led to levels of shoreline modification (59 percent of the shorelines) similar to the rest of the Puget Sound. The few commercial uses in the area are mostly related to recreation (e.g., marinas). The area is an important water recreation area.

Existing uses of state-owned aquatic lands in the area include such activities as marinas, utility crossings, and an industrial dock for the gravel mine on the eastern shore of Maury Island. These uses are either currently authorized by DNR, or require reauthorization.

1.4.8 Transportation

The Maury Island area is utilized extensively for waterborne transportation, although DNR has no management authority over such transportation.

1.4.9 Public Services and Utilities

Public services and utilities in the area consist of a number of public parks including: Dockton Park, Maury Island Marine Park, Burton Acres Park, and Point Robinson Park. There are several utility easements in the area that provide power, natural gas, and telecommunications to the island.

1.5 Impact Analysis

Table 2 presents a summary of the potential impacts of the proposed action alternatives on the elements of the environment described above (Section 1.4). As the proposed action is a non-project action, it is difficult to fully address and quantify the magnitude of potential negative and beneficial impacts. Instead, Table 2 summarizes the probability that some level

of beneficial or adverse impacts may occur. The effects analyses in Section 4.0 should be reviewed for further detail and clarification.

Table 2: Potential Impact of the Three Alternatives on the Affected Environment

Program Element	Alternative 1 (Preferred Alt.)	Alternative 2 (Repeal Reserve)	Alternative 3 (No Action)
Earth	Moderate probability of positive direct impacts to discrete locations throughout site.	Low probability of negative direct impacts to discrete locations throughout site.	Low probability of positive direct impacts to discrete locations throughout site.
Air	Low probability of positive indirect and cumulative impacts to areas in and around site.	Low probability of negative indirect and cumulative impacts to areas in and around site.	Low probability of positive indirect and cumulative impacts to areas in and around site.
Water	Moderate probability of positive direct, indirect, and cumulative impacts to areas in and around site.	Moderate probability of negative direct, indirect, and cumulative impacts to areas in and around site.	Low probability of positive direct, indirect, and cumulative impacts to areas in and around site.
Plants	Moderate probability of positive direct impacts to discrete locations throughout site and positive indirect and cumulative impacts to areas in and around site.	Moderate probability of negative direct impacts to discrete locations throughout site and negative indirect and cumulative impacts to areas in and around site.	Low probability of positive direct impacts to discrete locations throughout site and positive indirect and cumulative impacts to areas in and around site.
Animals	Moderate probability of positive direct and indirect impacts to discrete locations throughout site and to cumulative areas in and around site.	Moderate probability of negative direct and indirect impacts to small discrete locations throughout site and to cumulative areas in and around site.	Low probability of positive direct and indirect impacts to discrete locations throughout site and to cumulative areas in and around site.
Energy	No impact.	No impact.	No impact.
Natural Resource Use	Moderate probability of positive direct, indirect, and cumulative impacts to renewable natural resource use at areas in and around site. Low probability of direct negative impacts on state harvest of shellfish within the site. Moderate to high probability of adverse impacts on natural resource uses related to extraction of non-renewable resources from state-owned aquatic lands.	Moderate probability of negative indirect and cumulative impacts on renewable natural resource use in and around the site.	Low probability of positive direct, indirect, and cumulative impacts to renewable natural resource use at areas in and around site. Low probability of direct negative impacts on state harvest of shellfish within the site. High probability of adverse impacts on extraction of non-renewable resources.

Program Element	Alternative 1 (Preferred Alt.)	Alternative 2 (Repeal Reserve)	Alternative 3 (No Action)
Environmental Health	Moderate probability of positive direct, indirect, and cumulative impacts.	Moderate probability of negative direct and indirect impacts to discrete locations throughout site.	Moderate probability of positive direct, indirect, and cumulative impacts, but less than Preferred Alternative. Moderate probability of negative indirect impacts associated with trespass structures, non-point pollution, etc.
Land and Shoreline Use	Moderate probability of negative direct impacts to discrete locations throughout site. Moderate probability of positive impacts through increasing management certainty, increased resource protection, and ensuring management consistency with applicable land use regulations and policies.	No or negligible impacts.	Moderate probability of negative direct impacts to discrete locations throughout site. Low probability of direct positive impacts and local planning and indirect positive impacts on shoreline modification.
Transportation	Low probability of direct negative impacts on transportation systems and facilities.	No impact.	Moderate probability of negative direct impacts on transportation systems and facilities.
Public Services and Utilities	Moderate probability of negative direct impacts on public services and utilities at discrete locations throughout the reserve. Moderate probability of indirect benefits to public services throughout the reserve.	No Impact.	Moderate probability of negative direct impacts on public services and utilities at discrete locations throughout the reserve. Low probability of indirect benefits to public services throughout the reserve.

2.0 Introduction

Washington State's aquatic lands are extensive and diverse, including marine, estuary, river, and lake environments. The Washington Department of Natural Resources (DNR) is the steward for approximately 2.4 million acres aquatic lands, which are owned by the citizens of the state and managed in trust by DNR. As directed by the Washington State Legislature, DNR manages state-owned aquatic lands to provide a balance of public benefits. According to the Aquatic Lands Statutes (RCW 79.90 – 79.100), commonly referred to as the Aquatic Lands Act, those benefits include encouraging public access, fostering water-dependent use, ensuring environmental protection, and utilizing renewable resources (79.90.455). When consistent with other mandates, DNR also generates revenue from these lands to fund important state agency natural resource programs such as grants to local governments, environmental management efforts, and salmon recovery. In total, there are approximately 3,000 miles of saltwater shoreline (Nearshore Habitat Program 2001), 2.2 million acres of marine bedlands, and 230,000 acres of tidelands (Lanzer 1999). The DNR manages almost all of the marine bedlands and approximately 30 percent of the tidelands. In addition, DNR manages approximately 120,000 acres of freshwater bedlands and 30,000 acres of freshwater shorelands (from the line of navigability up to the ordinary high water mark) (Lanzer 1999).

Washington's aquatic lands have inherent biodiversity value and also support a wide range of species with economic, ecologic, and aesthetic value. Many state and federal endangered, threatened, sensitive, and candidate species depend on state-owned aquatic habitats.

Aquatic lands have been considerably degraded by historic and current human activities. For example:

- Nearly 60 percent of the lakes, streams, and estuaries, for which there is data, fail to meet water quality standards (Ecology 1998);
- There are more than 1,000 dams obstructing freshwater flow (Johnson 2000);
- More than 5,700 acres, approximately 1/3 of the total area surveyed for sediment quality, exceed sediment quality standards (Ecology 2003);
- More than one-third of all saltwater shorelines have undergone human-caused modification (Ecology 1998; Nearshore Habitat Program 2001).

In an effort to balance the elements of the Aquatic Lands Statutes (RCW 79.90 – 79.100), the DNR adopted WAC 332-30-151, which directs DNR to consider lands with educational, scientific, and environmental values for aquatic reserve status. The designation and management of aquatic reserves can be used as a tool to ensure environmental protection of the state's aquatic resources. The statutes that authorize DNR to withdraw lands from leasing activities and make the aquatic reserve program possible are RCW 79.90.460(3) and 79.10.210, as discussed in Section 2.3.

The state-owned aquatic lands within Quartermaster Harbor and on the east side of Maury Island (hereafter collectively referred to as the Maury Island site) were initially designated by DNR as an aquatic reserve in 2000. This original designation was done in the absence of clear guidance on the distinctions between the different types of reserve classifications or what activities should

be allowed in a reserve and how these areas would be managed. Therefore, to fully define and implement the aquatic reserve program, DNR issued the Non-Project Final Environmental Impact Statement: Aquatic Reserve Program Guidance on September 6, 2002. The programmatic Final Environmental Impact Statement (FEIS) provides a framework that: defines the three types of aquatic reserves (Environmental, Scientific, and Educational) and the measurable objectives for each; describes program administration, including the reserve application, review, and designation processes; and outlines general management actions for each of the three types of aquatic reserves.

Following completion of the aquatic reserve program FEIS, DNR began to implement the framework by first re-examining the six sites originally withdrawn from leasing by DNR in 2000. For the Maury Island site, DNR staff first researched the biotic and abiotic characteristics of the site and prepared a formal reserve application. Then a technical advisory committee (TAC), comprised of six scientists from agencies and academia, was created to evaluate the site based upon the criteria outlined in the aquatic reserve programmatic FEIS. After analyzing the site-specific characteristics, the TAC unanimously recommended that the Maury Island site be designated as an environmental aquatic reserve. This Supplemental Environmental Impact Statement (SEIS) examines whether the Maury Island site would meet the purpose, objectives, and need for an environmental aquatic reserve, evaluates potential environmental impacts of the proposed management strategies for the site, and determines whether management of a site can be effectively accomplished by DNR.

2.1 Purpose and Objectives of the Proposed Action

The purpose of the proposed action is to establish an appropriate management framework for the state-owned aquatic lands within Quartermaster Harbor and along the east side of Maury Island that are currently designated as an environmental aquatic reserve. The objective is to formalize specific management directives as a means to help achieve one of DNR's mandates under the Aquatic Lands Statutes (RCW 79.90 through 79.100) - ensure environmental protection. The Maury Island site was identified by DNR, and confirmed by the TAC, as a potentially suitable location for designation as an environmental aquatic reserve. In addition to environmental protection, DNR must consider its other proprietary mandates which include: encouraging direct public use and access, fostering water dependent uses, utilizing renewable resources, and generating revenue when consistent with the other objectives.

The following SEIS details the Preferred Alternative, which includes designating a formal boundary for the aquatic reserve and a proposed management plan and then evaluates the potential environmental consequences for this alternative. The SEIS also analyzes the potential effects of the No Action Alternative and a third alternative, which would repeal the reserve status for the Maury Island site.

2.2 Need for the Proposed Action

This proposed action is needed to address the growing pressures on aquatic lands and the increasing demand for aquatic resource use in Washington State. Development has contributed to the declining health of Puget Sound and the state's other aquatic resources, including coastal and freshwater systems. Species that are dependent upon those resources are impacted by the changes in the state's landscape and are declining in health and numbers.

In particular, the central Puget Sound basin, in which the Maury Island site is located, is the most heavily urbanized area in the Puget Sound (King County 2004). There is a decreasing amount of habitat in the central Puget Sound that exhibits historical functions and processes (Williams et al. 2000). The Maury Island site is highly productive, and provides important spawning habitat for a number of fish species including herring, surf smelt, and sand lance. The site contains a great deal of continuous eelgrass beds, which are a crucial aquatic habitat component. Juvenile Chinook salmon, protected under the federal Endangered Species Act (ESA), utilize Quartermaster Harbor for rearing and migration. These characteristics, and many others, of the Maury Island site make it an integral component of the central Puget Sound aquatic ecosystem and make it important to ensure protection of these resources through sound management practices.

However, DNR recognizes that a management framework for the Maury Island site must consider the public benefits of existing uses of the area. In addition, DNR must take into account its other statutory mandates, aside from environmental protection, as explained above in Section 2.1.

2.3 Legislative Authority and Mandate

State statute (RCW Title 79, Public Lands) vests authority for management of state-owned aquatic lands to DNR. This includes the authority to lease and sell aquatic lands in certain circumstances and under management guidelines imposed by the Legislature (see RCW 79.90 - 79.100). The specific statutes that give DNR the authority to protect state-owned aquatic lands include:

- RCW 79.10.210 authorizes DNR "... to identify and to withdraw from all conflicting use at such times and for such periods as it shall determine appropriate, limited acreage of public lands under their jurisdiction."
- RCW 79.90.460(3) authorizes DNR to "... consider the natural values of state-owned aquatic lands as wildlife habitat, natural area preserve, representative ecosystem or spawning area prior to issuing any initial lease or authorizing any changes in use. The department may withhold from leasing lands that it finds to have significant natural values, or may provide within any lease for the protection of such values."

Aquatic reserve status would not preclude all use authorizations, but only those inconsistent with the purpose of the reserve, as is described in further detail in Section 3.0 and in the proposed Maury Island Aquatic Reserve Management Plan. Proposed uses that are consistent with the purpose of the Maury Island Aquatic Reserve by protecting or perhaps enhancing the threatened aquatic environment and which meet DNR's other management guidelines may be authorized. State law contemplates that DNR may administratively decide that commercial enterprises should not be allowed to use certain lands that have a significant natural value. The DNR manages uses of state-owned aquatic lands that physically encumber the site, as well as other proprietary issues regarding these lands, such as removal of valuable materials and trespass, but does not regulate boating, fishing, recreation, or similar transitory uses that may cross over state-owned aquatic lands. Further, DNR does not have management authority over any private lands adjacent to the Maury Island site.

2.4 Relationship to Tribal Authorities

The Maury Island site is located within the Puyallup Tribe's exclusive usual and accustomed area. As such, it is essential that conservation goals and management activities be established in cooperation with the Puyallup Tribe. Under any of the alternatives evaluated in the following SEIS, DNR would engage in a government-to-government dialog with the Puyallup Tribe to ensure that their treaty right and trust responsibilities are upheld and not infringed upon in any way.

3.0 Alternatives

Under this section, alternatives for achieving the primary objective are discussed. First, the objectives for the alternatives and how DNR staff determined reasonable alternatives are reviewed under Section 3.1, followed by definitions of the three action alternatives (Sections 3.2 though 3.4). Section 4.0 describes the elements of the affected environment and evaluates the potential impacts of each alternative on specific elements of the natural and built environments.

3.1 Alternative Formulation and Objectives

The primary objective of this proposed agency action is to determine an appropriate management framework for the state-owned aquatic lands at the Maury Island site, which is currently designated as an environmental aquatic reserve. The Washington State Environmental Policy Act (SEPA) process calls for an evaluation of reasonable alternatives for meeting the primary objective. To aid in formulating alternatives for this SEIS, DNR representatives have consulted with public and private interests in a variety of forums. Public meetings were held at Vashon Island on May 14, 2003, October 28, 2003, and January 22, 2004. In addition, DNR staff conducted numerous individual meetings, as requested by specific stakeholders. Public comments in the form of e-mail messages and letters were also considered in drafting the action alternatives. A summary of scoping comments received and DNR's responses are provided in Appendix A.

Based on the scoping input and research conducted pertaining to the environmental conditions of the Maury Island site, DNR staff identified three action alternatives for analysis in this SEIS. The first alternative, which is also the Preferred Alternative, proposes to formalize a boundary for the Maury Island Environmental Aquatic Reserve and presents a management plan for the site. The second alternative evaluates rescinding the aquatic reserve designation for the site and returning the lands to the general state-owned land base, which would be available for leasing. The third alternative (No Action) evaluates the existing management strategy for the area with the site maintaining its reserve designation.

Under WAC 197-11.440(5)(vii), public agencies must consider the benefits and disadvantages of delaying the implementation of the proposed action as opposed to immediate approval. Because of the lag between the present time and when the Maury Island site was first designated as an aquatic reserve in 2000, this alternative is no longer a viable option and was rejected. Additional delay in evaluation of this site as a reserve would compromise the environmental value of the area under the guidance established in the programmatic FEIS. Further, the programmatic FEIS places potential DNR use authorizations/reauthorizations at the Maury Island site on hold until a decision is made regarding the management framework. Additional delays would burden existing users of the state-owned aquatic lands in the area or proponents of proposed uses.

3.2 Alternative 1 (Preferred Alternative)

This alternative proposes to establish a formal boundary and management plan for an environmental aquatic reserve comprised of approximately 5,530 acres of state-owned aquatic tidelands and bedlands within Quartermaster Harbor and along the east shoreline of Maury Island. The reserve would include about 23 linear miles of shoreline extending from

Neill Point to Point Robinson, in King County. A complete legal description is presented in Appendix B.

To aid in determining whether the Maury Island site should be designated as an aquatic reserve, DNR assembled the TAC to review the site and the reserve proposal. The TAC consisted of a group of six scientists from agencies and academia who were recruited in the spring of 2003. TAC members were selected based upon their education and professional expertise in marine, aquatic, and/or ecosystem sciences.

Upon review of the Maury Island proposal and a visit to the site, the TAC unanimously recommended that the Maury Island site be managed as an environmental aquatic reserve. Environmental aquatic reserves are designated to conserve (preserve, restore, and enhance) areas of environmental importance, maintain sites used for environmental baseline monitoring, and/or provide protective management for sites of particular historical, geological, or biological interest (WAC 332-30-106). The programmatic FEIS established 12 primary criteria for identifying appropriate locations for environmental aquatic reserves. These criteria are presented in Table 3.

Table 3: Environmental Reserve Designation Criteria

1. Viable and manageable site able to support rare, special, and unique features.
2. Habitat type is locally or regionally rare or of particular significance.
3. Site has the ability to persist over time.
4. Area has a high degree of natural biodiversity.
5. Site contains valuable or environmentally sensitive habitats.
6. Habitat is used by rare, listed, or valued aquatic species.
7. Habitat is essential for life stages of valued species (such as spawning and nursery areas for threatened and endangered species, including salmon, herring, smelt, and sand lance).
8. Current physical, chemical and biological processes that maintain habitat are intact or restorable.
9. Habitat could support critical life stages of valued or protected species if restored.
10. Restoration of area will result in an ecologically functioning habitat.
11. Site contains valuable geological, cultural, and/or archeological resources.
12. A history of monitoring or an opportunity for long-term monitoring of the site.

In their review of the Maury Island site, the TAC noted a variety of characteristics that prompted their recommendation for environmental aquatic reserve designation, including:

- The site supports significant spawning areas for a major herring stock;
- Quartermaster Harbor is identified by the Audubon Society as an Important Bird Area and in particular an important area for wintering marine birds, especially western grebes;

- There are extensive eelgrass flats throughout the site;
- The eastern shore of Maury Island is a unique continuous drift cell that converges with another drift cell at Point Robinson;
- The habitat and species found in the area make it a good site for conservation in the central Puget Sound region;
- There is high biodiversity at the site in comparison to other areas in the ecoregion; and
- Reserve status would encourage local government and citizens to promote conservation planning and management in the area.

Based upon the TAC recommendations, additional research, and public input, DNR formulated a draft management plan for Maury Island site (DNR 2004). The plan would guide DNR management of the site over the proposed 90-year term of the aquatic reserve. The purpose of the management plan is to proactively identify conservation needs, issues and threats, management goals and actions, and inventory and monitoring mechanisms for the Maury Island site. The management plan is intended to emphasize environmental protection in the area and include actions flexible enough to respond to environmental changes within and adjacent to the reserve. The plan is also meant to be prescriptive enough to provide guidance for existing and proposed future uses of state-owned aquatic lands.

3.2.1 Aquatic Reserve Boundary

The proposed boundary under the Preferred Alternative includes the state-owned tidelands from Neill Point along the southeastern shoreline of Vashon Island, all of Quartermaster Harbor, and the eastern shoreline of Maury Island up to the furthest extent of state-owned tidelands immediately north of Point Robinson (Figure 1). The boundary would extend waterward from the landward extent of state ownership to a water depth of 70 feet (21.4 meters) below mean lower low water or one-half mile from the line of extreme low tide, whichever line is further waterward. A full legal description of the lands that would be contained in the proposed reserve boundary is included in Appendix B.

Figure 1: Maury Island Aquatic Reserve Boundary: Preferred Alternative

For a color version of this figure see http://www.dnr.wa.gov/htdocs/aqr/reserves/home.htm.

In determining the proposed boundary for the Preferred Alternative, DNR staff originally considered three possible options for the reserve boundary, options A, B, and C (Appendix C). Option B is the proposed boundary under the Preferred Alternative. Option A was the smallest boundary considered in terms of geographic area and included lands from Neill Point to the furthest extent of surveyed herring spawning area along the eastern shore of Maury Island. As stated above, the proposed boundary under the Preferred Alternative is comprised of all of the lands in option A and also includes the

entire eastern shore of Maury Island to the furthest extent of state-owned tidelands at Point Robinson. The third option was the boundary originally established for the reserve site in 2000 and is the boundary for the No Action Alternative, which includes options A, B, and an additional tract of land to the west of Point Robinson (Appendix C). Boundary options A, B, and C encompass 4,376, 5,530, and 5,866 acres of state-owned aquatic lands, respectively (Table 4).

Table 4: Maury Island Aquatic Reserve Boundary Option Characteristics

Boundary Option	Boundary Option Area (acres)[a]	Miles of Shoreline[b]	Area of Adjacent Private Tidelands[a]
A	4,376	20.9	579
B[c]	**5,530**	**23.4**	**691**
C	5,866	24.4	717

a: areas are estimates and are ± 100 acres
b: shoreline length is ± 0.1 miles
c: bold denotes that Option B is the boundary used in the Preferred Alternative

Through public scoping and internal DNR review, boundary option B was established as the preferred option and is the proposed boundary under the Preferred Alternative. The reasoning for this determination is that this boundary would:

- Include all of the surveyed herring spawning areas;
- Capture the entire drift cell along the east shore of Maury Island (from Piner Point to Point Robinson);
- Encompass the entire convergence zone of the east shore drift cell and the drift cell along the north shore of Maury Island; and
- Provide opportunities for public recreation and possibly education at Point Robinson and the Maury Island Marine Park.

In addition, the tidelands (those aquatic lands from mean high tide to extreme low tide) adjacent to Point Robinson are in state ownership and included within the boundary of the aquatic reserve, and therefore can be more consistently managed with subtidal aquatic lands. Tidelands to the north of the proposed boundary for the Preferred Alternative are not in state ownership.

Boundary option A is not being carried forward by DNR, as it does not include the drift cell and other aquatic habitat features along the eastern shoreline of Maury Island. Boundary options C was not chosen for the Preferred Alternative as it encompasses only a small portion of a larger drift cell that extends along the northern shoreline of Maury Island. The aquatic reserve program places emphasis on including whole ecosystem and habitat components versus fragmented conservation of ecological features, and the current configuration of boundary option C does not meet this objective.

Furthermore, WAC 197-11-440(5)(b) states that "reasonable alternatives shall include actions that could feasibly attain or approximate a proposal's objectives but at a lower

environmental cost or decreased level of environmental degradation." The proposed boundary maximizes protection of the key elements of the natural environment identified for protection at the Maury Island site, while not further encumbering lands along the northern shoreline that do not meet the environmental management objectives for the Preferred Alternative.

It is important to emphasize, that the proposed reserve boundary is only comprised of state-owned aquatic lands, which includes a relatively small portion (12 percent) of the existing intertidal area of Quartermaster Harbor and the east side of Maury Island. In addition, DNR's Aquatic Resources Program does not have jurisdiction over any of the uplands adjacent to the reserve boundary.

3.2.2 Goals and Objectives

The reserve was designated to conserve (preserve, restore, and/or enhance) the habitats and species that make the site desirable for conservation. The proposed Maury Island Aquatic Reserve goals are broad statements of desired future condition. The DNR has formulated the following goals to conserve the critical habitats and associated species identified in the management plan, including:

I. Preserve, or restore and enhance where there are opportunities, native habitats and associated plant and wildlife species, with a special emphasis on forage fish, salmonids, and migratory birds.

II. Preserve, or restore and enhance where there are opportunities the functions and natural processes of nearshore ecosystems, with a special emphasis on support of the natural resources of the reserve.

III. Promote stewardship of riparian and aquatic habitats and species by providing education and outreach opportunities and promoting coordination with other resource managers.

IV. Support traditional recreational (i.e., boating, water skiing, fishing), commercial (i.e., marinas), and cultural uses in and adjacent to the site and promote responsible management of these uses in a manner consistent with the other goals for the reserve.

Aquatic Reserve objectives reflect what should be achieved to meet particular goals. When possible, reserve objectives are intended to be specific, measurable, achievable, and results oriented. The proposed objectives are listed below as they apply to each of the reserve goals.

I. Preserve, or enhance where there are opportunities, native habitats and associated plant and wildlife species, with a special emphasis on forage fish, salmonids, and migratory birds.

This goal may be achieved by:

- *Protecting fish spawning and rearing habitat and movement corridors.* Protect documented spawning and rearing areas from impacts associated with new developments on state-owned aquatic lands. Over time, reduce or eliminate the

impacts associated with existing developments on state-owned aquatic lands that affect ecological functions that support spawning and rearing habitat. Desired future conditions for forage fish habitat and salmon spawning, rearing, and migratory habitats are described in sections 4.5.8 and 4.5.9 of the management plan.

- *Identifying and minimizing sources of fish mortality resulting from human activities.* Continue monitoring efforts to identify interactions between fish and toxic materials, low dissolved oxygen conditions, and nutrients within the reserve. Wherever possible, eliminate sources of mortality resulting from human activities as they are identified.
- *Maintaining Clean Water Act standards for water and sediment quality.* Maintain water and sediment quality such that listing of waterbodies or segments within the reserve as impaired under the Clean Water Act is unnecessary. Desired future conditions for water and sediment quality are described in section 4.5.2 of the management plan.
- *Sustaining or increasing the documented extent and species composition of native aquatic vegetation.* A biomass index comprised of bed area and bed density may be established to reflect native kelp and eelgrass bed conditions at reserve establishment. The biomass index of eelgrass and kelp beds may not decrease due to human-induced impacts from the baseline level that reflect the area and density at reserve establishment. Desired future conditions for kelp and eelgrass beds are described in sections 4.5.6 and 4.5.7 of the management plan.
- *Protecting and restoring intertidal sand and mudflats.* Maintain the total area of sand and mudflats documented to exist at the time the reserve is established. Desired future conditions for intertidal sand and mudflats are described in section 4.5.5 of the management plan.
- *Preventing non-indigenous organisms from invading or disrupting the ecosystem.* Prevent non-indigenous species not already found within the reserve from establishing populations within the reserve. For those established non-indigenous species that have the capacity to disrupt the ecosystem, undertake appropriate management actions to reduce the abundance and threat to the ecosystem posed by the non-indigenous organisms.
- *Protecting nearshore migratory bird habitat.* Maintain undisturbed shoreline habitats where birds can rest and feed during their annual winter migration. Desired future conditions for marine bird habitat are described in section 4.5.10 of the management plan.
- *Supporting the recovery and protection efforts for Federal and State threatened and endangered species, species of special concern and their habitats.* Identify, monitor and protect all special-status plant and animal species found in the reserve, focusing on species that are state or federally listed, proposed for listing, or candidates for listing. DNR may work with WDFW, NOAA and USFWS to support recovery of Chinook salmon and bull trout, if present, by protecting and restoring suitable habitats within the reserve.

II. Protect and restore the functions and natural processes of nearshore ecosystems in support of the natural resources of the reserve.

This goal may be achieved by:

- *Maintaining the integrity and function of nearshore drift cell processes.* Support voluntary efforts by private landowners to reduce impacts of shoreline modification on nearshore drift cell processes. Target a reduction of shoreline hardening to less than 30 percent of the shorelines throughout the reserve. Support restoration projects that demonstrate ecological benefits and feasibility of shoreline softening to shoreline landowners. Desired future conditions for nearshore drift cells are described in section 4.5.3 of the management plan.
- *Protecting and restoring hydrologic functions and water quality of stream mouth estuaries.* Support efforts to maintain natural flow regimes in streams and seeps entering the reserve. Desired future conditions for stream mouth estuaries are described in section 4.5.4 of the management plan.
- Working cooperatively to identify and minimize existing and potential future impacts on the nearshore environment resulting from outfalls and runoff discharging to the reserve. Monitor nearshore water quality for signs of impairment resulting from outfalls or runoff discharging to the reserve. Support local efforts to manage and treat stormwater, sewage, and gray water discharging to the reserve.

III. Promote stewardship of riparian and aquatic habitats and species by providing education and outreach opportunities and promoting coordination with other resource managers.

This goal may be achieved by:

- *Promoting voluntary habitat conservation efforts within and adjacent to the reserve.* Provide trainings and educational materials to shoreline owners describing conservation benefits, best practices, and conservation incentive programs. Establish relationships with local stakeholders to support the reserve's function in providing ecosystem services to the local community.
- *Creating opportunities for public involvement in the management of the reserve.* Create and distribute annual summaries of reserve related activities, achievements and programs. Form and support diverse, stakeholder-based groups to give meaningful, timely input to the DNR regarding the Maury Island Aquatic Reserve.
- *Supporting scientific research and education related to management of the reserve through identifying and prioritizing research needs in relation to the goals identified in this section.* The DNR may work with other agencies and organizations to provide assistance to other programs by designing, conducting, or hosting at least one regionally based environmental education field trip, workshop, seminar, or study course each year. Partner with educational groups to develop and post interpretative materials describing natural resources found within the reserve.

IV. Support traditional recreational (i.e., boating, water skiing, fishing), commercial (i.e., marinas), and cultural uses in and adjacent to the site and promote responsible management of these uses in a manner consistent with the other goals for the reserve.

This goal may be achieved by:

- *Working in cooperation with lessees and recreational user groups to minimize and reduce identified impacts of human activities on the species and habitats within the reserve.* The DNR may take a leadership role in developing and strengthening partnerships, including working with volunteers, and may conduct a variety of outreach efforts to more effectively achieve reserve goals and contribution to the protection and enhancement of the aquatic ecosystems of Vashon and Maury islands.
- *Fostering public access to state-owned aquatic lands within the reserve in a manner consistent with the other management goals for the site.* Work with partners to provide safe and attractive opportunities to access public lands within and adjacent to the reserve. The reserve may provide a variety of quality boat and shoreline interactions with aquatic resources that are safe, consistent with state regulations, and compatible with reserve resources and purposes.
- *Supporting the integrity of adjacent archaeological, cultural, or historical sites.* The reserve may promote a deeper appreciation and understanding of the archaeological, cultural, and historical sites adjacent to the reserve. Desired future conditions for archaeological, cultural, and historical resources are described in section 4.5.11 of the management plan.

3.2.3 Management Plan Provisions

The following section provides a brief summary of the management provisions included in the management plan for the Maury Island site, which is the basis of the Preferred Alternative. The following summary is provided to aid in comparing the Preferred Alternative to the other two action alternatives and to facilitate assessment of potential environmental impacts. The draft management plan (DNR 2004) should be carefully reviewed for specific details and clarification pertaining to proposed management provisions.

The proposed management plan would serve as a tool to help DNR ensure environmental conservation (preservation, restoration, and enhancement) of state-owned aquatic lands. While the DNR manages for a balance of public benefits (including environmental protection, public use and access, water dependent navigation and commerce, natural resource use, and revenue generation), on all state-owned aquatic lands, the emphasis within the reserve would be on ensuring environmental protection. The other benefits may take place within the reserve, but must meet the criteria established in the management plan for the site.

The primary habitats and species at the site that the management plan is designed to conserve include: aquatic vegetation (i.e., eelgrass and kelp); nearshore drift cells; water

and sediment quality, intertidal sand and mudflats; estuarine habitat; forage fish (i.e., pacific herring, sand lance, and surf smelt) and their habitats; salmonid rearing and migratory habitat; and marine bird habitat. In addition, the management plan would help to ensure the protection of archeological, cultural, and historical resources within and adjacent to the site.

3.2.3.1 Research and Monitoring

Since most of the long-term goals and management strategies for the proposed reserve depend upon understanding the baseline ecological conditions within the site, a major emphasis during the first ten years of reserve designation would be placed on establishing these baseline conditions.

The DNR would utilize existing information as the starting point for establishing baseline conditions. Where data or information gaps exist, a thorough inventory of the resources within the reserve would be undertaken. The DNR may seek to partner with the Washington Department of Ecology, WDFW, the King County Department of Natural Resources, and local community groups to coordinate baseline inventory efforts.

After baseline ecological conditions are identified, specific management objectives and actions would be refined following an adaptive management process. In addition, effectiveness monitoring would be conducted on regular intervals to aid in the assessment of the success of reserve management strategies in meeting the goals and objectives of the reserve.

The DNR would also seek partnerships with Ecology, WDFW, King County, academic scientists, and local community groups to identify and develop research projects within the reserve, which would increase understanding of the physical and biological conditions of the area and could ultimately lead to better management of the site.

3.2.3.2 Management Guidance for Existing and Future Use Authorizations

General Programmatic Principles: The following provisions apply only to activities that require a use authorization (e.g., lease, license, easement, right of entry) from DNR to use state-owned aquatic lands within the proposed reserve boundary.

- Activities must primarily serve the objective of the reserve designation. An activity would be considered to primarily serve the objective of the reserve if it would not create additional temporal or spatial impacts to the reserve habitats and species. Proposed uses of the area would need to fully demonstrate that additional impacts to the species and habitats targeted for conservation within the reserve would not be degraded (no net loss) over existing conditions. Any compensatory mitigation required for a project to meet this condition must occur within the reserve or provide direct benefits to the reserve. Mitigation must be fully constructed prior to construction of the impacting use.

- Project proponents must also implement conservation activities (i.e., monitoring, research, habitat improvement, land acquisition, education and outreach) in support of the reserve. Factors for determining the level of conservation activities to be implemented by a project proponent would include the size of the area, intensity and frequency of use, location of activity in relation to specific habitat and species use, and exclusivity of use.
- In addition, existing uses must develop a site management plan in consultation with DNR to identify measures that would be implemented to reduce site-specific environmental impacts from existing facilities and uses over the 90-year period of the reserve. The reduction of impacts of a facility would be implemented as the remaining economic life of the existing structure is realized or there are proposed expansions or upgrades to the facility.
- Plans must be developed and implemented by project proponents to monitor impacts to reserve habitats and species from existing and proposed activities.
- Adaptive management strategies must be developed and implemented by project proponents to ensure improved operations and reduced impacts to reserve habitats and species over time.

General Management Strategies for Uses: Activities within the reserve would be evaluated based on their potential environmental impacts and intensity of use relative to the management unit in which the activity is proposed. The management plan outlines over twenty possible uses that could be proposed to occur within the reserve and discusses the general management strategies and permissibility of such activities within the three management zones of the reserve. Table 5 contains a matrix that lists the types of uses that may be proposed and the general management strategies for each. Again, the draft management plan (DNR 2004) should be consulted for a complete description of this information.

Table 5: Overview of General Management Strategies for Potential Activity Proposals

MANAGEMENT ACTIVITY	MANAGEMENT ACTIONS			PRIMARY IMPACTED RESOURCE	GOAL
	Inner Quartermaster	Outer Quartermaster	Maury Isl. E. Shore		
Stormwater Outfalls	No direct discharge to reserve area. Upland treatment and infiltration to groundwater, streams, or wetlands to be re-introduced to marine waters through natural hydrologic processes.		No direct discharge to reserve area. Upland treatment and infiltration to groundwater, streams, or wetlands to be re-introduced to marine waters through natural hydrologic processes – OR – might consider discharge area of impact to extend beyond the boundary of influence or habitat of concern (eelgrass, herring holding area, salmon migratory habitat, near shore zone).	Water quality, nutrient input, toxics, sediment input, flow rate, mixing, temperature, dissolved oxygen, salinity.	No shellfish closures due to water quality concerns. Meet Clean Water Act standards. Maintain sediment quality.
Sewage Outfalls	No direct discharge to reserve area. Upland treatment and infiltration to groundwater, streams, or wetlands to be re-introduced to marine waters through natural hydrologic processes.		No direct discharge to reserve area. Upland treatment and infiltration to groundwater, streams, or wetlands to be re-introduced to marine waters through natural hydrologic processes – OR – might consider discharge area of impact to extend beyond the boundary of influence or habitat of concern (eelgrass, herring holding area, salmon migratory habitat, near shore zone).	Water quality, nutrient input, toxics, sediment input, flow rate, mixing, temperature, dissolved oxygen, salinity.	No shellfish closures due to water quality concerns. Meet Clean Water Act standards. Maintain sediment quality.

MANAGEMENT ACTIVITY	MANAGEMENT ACTIONS			PRIMARY IMPACTED RESOURCE	GOAL
	Inner Quartermaster	Outer Quartermaster	Maury Isl. E. Shore		
Water Intakes	No intakes near fish spawning, migratory, or rearing areas. Intakes should generally be placed deeper than –30 ft. MLLW. All intakes must adhere to WDFW screening criteria.			Removal or destruction of habitat and disruption of fish larval dispersal. Direct entrainment of marine species.	No loss of juvenile fish or adult crustaceans related to intakes. No destruction of aquatic habitat related to intakes.
Desalinization Facilities	Same as "intake" above. No discharge of desalination wastewater or concentrated minerals to marine waters.		Same as "intake" above. No discharge of concentrated minerals to marine waters. Prefer no direct discharge of wastewater to reserve area – OR – might consider discharge area of impact to extend beyond the boundary of influence or habitat of concern (eelgrass, herring holding area, salmon migratory habitat, near shore zone).	Water quality, habitat disruption, direct entrainment of marine organisms.	No loss of juvenile fish or adult crustaceans related to desalinization intakes or outfalls. No destruction of aquatic habitat related to desalinization intakes or outfalls. Maintain existing ambient salinity levels.
Cable Crossings	Permissible. Required to route cable around or drilling below critical habitat. Must avoid all surface and sub-surface impacts to critical aquatic habitat and species. Proponents must survey and video seabed to show proposed installation site is free of vegetation. Installation period must comply with WDFW in-water work periods. Prefer that shore-ends use directional drilling or rock-pinning/split-pipe remedial protection if the shore-end is either rocky or an erosional area. When burial is an acceptable installation method, plowing is the preferred method over water-jetting remote operated vehicle.			Aquatic vegetation, other aquatic rearing and migratory habitat, disruption of near shore drift, localized habitat degradation.	No disturbance of vegetated areas during construction. No post construction project footprint on surface within euphotic zone.

MANAGEMENT ACTIVITY	MANAGEMENT ACTIONS			PRIMARY IMPACTED RESOURCE	GOAL
	Inner Quartermaster	Outer Quartermaster	Maury Isl. E. Shore		
Oil, gas, water, and other pipelines	Same as cable crossings. Additionally, pipelines must be directionally drilled below the reserve to depths of minus 70 feet at MLLW or ½ mile from the MHW line. The project proponent must demonstrate the ability to detect leaks of less than 0.1% of total flow for each segment.			Aquatic vegetation, other aquatic rearing and migratory habitat, disruption of near shore drift, localized habitat degradation.	No disturbance of vegetated areas during construction. No post construction project footprint on surface within euphotic zone. Protect reserve resources from leaks of toxic chemicals.
Fish Pens	Not permissible.	Conditional – Herring holding in pens is not permitted during periods of herring spawning (Jan. through mid-April). In addition, pens being utilized to hold herring may only be sited in areas of adequate flushing to ensure there are no water quality impacts. No floating aquaculture facility may be located over aquatic vegetation or documented spawning habitat and shall not be located in the intertidal zone.		Aquatic vegetation, other rearing and migratory habitat, water quality, euphotic zone, herring spawning habitat.	Herring disease levels consistent with pre-project baseline conditions. No disturbance to aquatic vegetation or euphotic zone.
State Commercial Geoduck Harvest	Only on commercial tracts and performed with no impacts to aquatic habitat and species identified in the management plan. Harvest must be consistent with the guidance established in the FSEIS for the state commercial geoduck fishery and associated management plan.			Aquatic vegetation, migration, spawning and rearing habitat, intertidal substrate.	No disturbance of aquatic vegetation. No long-term turbidity increases. No disruption of fish spawning or rearing.
Shellfish Aquaculture	Permissible with no impacts to conservation features of aquatic habitat and species identified in the management plan. Use of herbicides and pesticides, cutting, tilling, or otherwise disturbing native aquatic vegetation is not permissible.			Aquatic vegetation, migration, spawning and rearing habitat, intertidal substrate.	No disturbance of aquatic vegetation. No long-term turbidity increases. No disruption of fish spawning or rearing.

MANAGEMENT ACTIVITY	MANAGEMENT ACTIONS			PRIMARY IMPACTED RESOURCE	GOAL
	Inner Quartermaster	Outer Quartermaster	Maury Isl. E. Shore		
Marinas and Public Docks	Existing marinas permissible with long-term management plan that outlines time frames for upgrades to reduce impacts. New Marinas – Contingent on siting study to be conducted for the reserve in coordination with local user groups and applicable local, state, and federal government agencies. New marinas must provide pump-out facilities and no covered slips.		Contingent on siting study to be conducted for the reserve in coordination with local user groups and applicable local, state, and federal government agencies. New marinas must provide pump-out facilities and no covered slips.	Euphotic zone, aquatic vegetation, water quality, sediment contamination, hydrologic alterations, and fish predation.	No disturbance of aquatic vegetation. Meet Clean Water Act standards. Maintain sediment quality. No disruption of fish spawning or rearing.
Breakwaters on State Land	Conditional – Limited to only floating breakwaters and specific uses that can show the immediate need for facility, structural, or private property protection to alleviate risk of eminent damage. Must be designed to promote circulation and minimize barriers, limit shading, and use environmentally neutral materials.			Hydrologic alterations, drift cells, aquatic vegetation, and fish predation.	No disturbance of aquatic vegetation. Promote natural hydrologic regime. Avoid drift cell disruptions. No disruption of fish spawning, rearing, or migration.
Boat repair facilities on state land	Not permissible.			Water quality and contaminated sediment.	Meet Clean Water Act standards. Maintain sediment quality.
Industrial Wharves and Piers	Conditional- only if new structure creates no net additional impacts (no net-loss) to the habitat and species identified for conservation at the site, and implements actions to primarily serve the purpose of the reserve.		Limited to area adjacent to upland mineral zoning in King County Comprehensive Plan. Conditional only if new structure creates no net additional impacts (no net-loss) to the habitat and species identified for conservation at the site, and implements actions to primarily serve the purpose of the reserve. Existing facilities must upgrade their facility to reduce	Water quality, hydrologic alterations, drift cells, aquatic vegetation, and adverse species interactions.	No disturbance of aquatic vegetation. Promote natural hydrologic regime. Avoid drift cell disruptions. No disruption of fish spawning, rearing, or migration.

MANAGEMENT ACTIVITY	MANAGEMENT ACTIONS			PRIMARY IMPACTED RESOURCE	GOAL
	Inner Quartermaster	Outer Quartermaster	Maury Isl. E. Shore		
			impacts over time.		
Mooring Areas, Recreational Mooring Buoys, and Private Recreational Docks on State-Owned Aquatic Lands	DNR may inventory existing buoys and establish ownership; cooperate with owners to identify appropriate installation methods, locations, and maintenance practices; and authorize buoys on state-owned aquatic lands (adjacent landowners may install and maintain a recreational dock or mooring buoy at no fee). Until the inventory actions are completed, existing mooring areas would be allowed to remain. In the future, DNR would remove abandoned buoys, ensure proper installation, and promote public awareness of location of eelgrass and forage fish spawning locations.			Aquatic vegetation, forage fish spawning and rearing habitat, water quality.	No disturbance of aquatic vegetation. Meet Clean Water Act standards. Maintain sediment quality. No disruption of fish spawning, rearing, or migration.
Residential Use (Live Aboards)	Limited to existing marinas and according to the limitations of DNR regulations in WAC 332-30-171 and King County Shoreline Master Program.	Not permissible.		Water quality, hydrologic alterations, drift cells, aquatic vegetation, and adverse species interactions.	No disturbance of aquatic vegetation. Meet Clean Water Act standards. Maintain sediment quality. No disruption of fish spawning, rearing, or migration.
Log Storage/Booming	Not permissible.			Euphotic zone, substrate, aquatic vegetation, sediment quality.	No disturbance of aquatic vegetation. Meet Clean Water Act standards. Maintain sediment quality.
Dredging	Not permissible, unless for federal transportation projects.			Substrate, water quality, aquatic vegetation, fish spawning, rearing, and migration.	No disturbance of aquatic vegetation. Meet Clean Water Act standards. Maintain sediment quality. No disruption of fish

MANAGEMENT ACTIVITY	MANAGEMENT ACTIONS			PRIMARY IMPACTED RESOURCE	GOAL
	Inner Quartermaster	Outer Quartermaster	Maury Isl. E. Shore		
					spawning, rearing, or migration.
MTCA/CERCLA Sites	Support reserve conservation goals and manages uses within the reserve to prevent future sediment contamination.			Sediment quality, water quality.	Meet Clean Water Act standards. Maintain sediment quality.
Voluntary Restoration and Enhancement	Encouraged throughout the reserve based on recognized priorities. DNR would review existing inventories of potential restoration activities and in voluntary cooperation with interested parties would develop a site-specific prioritization; secure funding for habitat improvement projects; and implement projects within the reserve.			Euphotic zone, aquatic vegetation, water quality, sediment quality, hydrologic alterations, drift cells, fish populations and habitat.	Maintain and improve aquatic habitat conditions within the reserve.
Mitigation and Mitigation Banking	Projects within reserve must be fully mitigated and compensatory mitigation must be installed prior to project-related impacts occurring. Mitigation activities for projects outside of the reserve must improve aquatic habitat conditions within the reserve. Mitigation banks that meet the mitigation requirements above would be encouraged throughout the reserve based on priorities identified in the management plan or other documented publications.			Euphotic zone, aquatic vegetation, water quality, sediment quality, hydrologic alterations, drift cells, fish populations and habitat.	Maintain and improve aquatic habitat conditions within the reserve.
Unauthorized and Trespass Structures	DNR would develop an inventory of structures, determine the types of uses, and determine possible impacts to habitats and species identified in this plan. Activities that pose no or minimal impact can be authorized; inappropriate or impacting uses would not be authorized and treated as a trespass.			Aquatic vegetation, water quality, sediment quality, hydrologic alterations, drift cells, fish spawning, rearing, and migratory habitat	Maintain and improve aquatic habitat conditions within the reserve.

Specific Management Strategies for Authorized and Pending Uses: Under the management plan, existing authorized uses and those currently negotiating authorizations within the reserve would be subject to the same general programmatic requirements and the management strategies described for each use type (Table 5). As existing uses may already have caused or currently cause impacts to the species and habitats targeted for conservation within the reserve, these authorized uses would also be required to develop site plans that would identify measures to reduce any ongoing site-specific environmental impacts related to existing facilities and implement these over the course of the 90-year term of the reserve.

In the management plan, DNR has identified specific issues related to the existing or pending authorized uses that the proponents would be required to consider when acquiring authorization, upgrading, or expanding an existing use. These specific activities for each existing use would be designed to reduce existing and continuing impacts associated with the authorized use.

For example, to reduce existing and continuing impacts of the facilities, the Quartermaster Yacht Club, Quartermaster Harbor Marina, and the Dockton County Marina would need to consider implementation of actions such as, but not limited to:

- Upgrade piers to enhance water circulation;
- Limit shading;
- Employ "soft" armoring erosion control measures;
- Maintain a pump-out facility;
- Provide shoreside restrooms;
- Expand landward;
- Monitor potential impacts; and
- Other actions as outlined in the management plan (DNR 2004).

Glacier Northwest's Maury Island gravel barge loading facility would need to consider measures to reduce the impacts of the existing structure over time, which may include:

- Remove existing chemically treated pilings;
- Utilize environmentally neutral materials in new construction;
- Infiltrate stormwater in upland areas;
- Construct the upgraded facility as to not increase existing levels of overwater shading;
- Design facility to minimize hydrologic alterations and disruption to nearshore drift;

- Minimize noise and light impacts associated with construction and operation of the facility;
- Monitor potential impacts; and
- Other actions as outlined in the management plan (DNR 2004).

The Puget Sound Energy Utility cable crossings would not be required to implement additional measures to reduce environmental impacts, as they do not require active management and do not impact the habitats and species identified for conservation within the reserve. However, repair or maintenance activities would be required to consider impacts to habitats and species identified for conservation. Puget Sound Energy would not be required to implement actions to primarily serve the objectives of the reserve unless upgrades or additional construction were proposed in the area, as the current use authorizations are valid in perpetuity.

Comcast's proposed fiber optic cable crossing would be required to ensure that it will not degrade any of the habitats and species within the reserve and adhere to the general requirements for cable crossings presented in Table 5.

The purpose of the specific actions described for existing uses within the reserve would be implemented to reduce existing and continuing impacts of these facilities over time. The draft management plan (DNR 2004) should be reviewed for the complete description of suggested improvements to existing facilities.

3.2.3.3 DNR Led and Partnering Activities

The management plan identifies a number of activities to be implemented within the reserve that may not require a use authorization but could be implemented by DNR or in partnership with other entities. These activities (i.e., derelict vessel removal, aquatic nuisance species management) would be conducted in an effort to better meet the goals and objectives for the reserve.

Derelict Vessels: The DNR would inventory existing derelict or abandoned vessels throughout the reserve, regularly identify the arrival of new derelict or abandoned vessels, and remove vessels, as practicable, per the DNR Derelict Vessel Program guidelines.

Land Acquisition for Habitat: The DNR would work with King County, the Vashon-Maury Island Land Trust, and other interested parties to establish priorities for habitat acquisition; identify opportunities and secure funding to acquire habitat; and work cooperatively with owners of adjacent lands (on a voluntary basis) to identify habitat conservation activities that could be implemented when acquisition is not an option. If intertidal areas directly adjacent to the reserve are acquired by the state, then DNR can choose to include these lands in the aquatic reserve.

Aquatic Nuisance Species Management: Aquatic nuisance species that were identified in the reserve would be managed in cooperation with the Washington

Department of Agriculture, WDFW, and the King County Noxious Weed Board. Priorities for aquatic nuisance management would be developed through implementation of the management plan.

Transient Public Recreational Use: The DNR does not have regulatory authority to manage transient public recreational activities on state-owned aquatic lands (i.e., boating, fishing, shellfishing, swimming, beach walking, etc.). Under the management plan, DNR would promote and encourage appropriate, legal transient public recreational activities within the reserve conducted in a manner that conserves the habitats and species of the reserve. To accomplish this, DNR would inventory existing recreational uses and determine if activities are causing impacts to the habitats and species targeted for conservation within the reserve. If it is determined that impacts are occurring, DNR would work cooperatively with user groups and appropriate regulatory agencies to identify opportunities for voluntary efforts that would avoid and minimize impacts.

Outreach and Education: The DNR would work with user groups, local environmental groups, local clubs, and other interested citizens to implement a number of education and outreach actions such as:

- Placement of signs and boundary markers in and adjacent to the reserve;
- Dissemination of information on BMPs related to bulkheads, riparian management, septic tanks/fields, docks, and mooring buoys to local residents;
- Dissemination of information on BMPs for commercial activities (e.g., docks and marinas) to businesses;
- General education activities such as school visits, shoreline stewardship walks, and interpretive signage;
- Identification of opportunities (such as locating funding sources) to interface voluntary management of private aquatic lands with the aquatic reserve management; and
- Development of a process for working with local jurisdictions, regulatory agencies, and adjoining landowners to identify and minimize off-site impacts.

3.2.3.4 Private and Public Lands Adjacent to the Aquatic Reserve

Approximately 88 percent of the tidelands in Quartermaster Harbor and the east shore of Maury Island are not state-owned aquatic lands under DNR management. Tidelands not managed by DNR may be owned and managed by other public agencies including King County, WDFW, U.S. Coast Guard, or may be in private ownership. DNR has identified activities that occur on aquatic lands and uplands that may impact habitats and species identified for conservation in the reserve. The management plan provides strategies for DNR to potentially address some of these issues, as discussed below.

Shoreline Modification: In areas not owned by the state, DNR would work in cooperation with local landowners on a voluntary basis on efforts to reduce the impacts of shoreline hardening. The DNR would also seek funding sources and incentive programs to facilitate the improvement of shoreline conditions.

Non-Point Source Pollution: The DNR would review past and present non-point source pollution programs; identify sources of non-point pollution with the Maury Island site; and work cooperatively with King County and local entities to address these concerns. The DNR would also seek funding sources to assist in these efforts.

Docks, Floats, and Mooring Buoys on Private Property: The DNR has no management authority over docks, floats, and mooring buoys located on private property. However, to help address potential impacts that may be associated with these structures, DNR would work cooperatively with landowners (on a voluntary basis) to identify ways to reduce possible impacts from these structures and would also seek funding to facilitate these efforts.

3.2.4 Commissioner's Order

Between the draft and final SEIS, DNR will prepare a Public Benefits Analysis to evaluate whether the proposed management plan would best serve the public benefit. After the SEPA process has been completed and if the Public Benefits Analysis were to find that the proposed management plan best serves the public benefit, then the Commissioner of Public Lands would proceed to formalize the reserve. The Commissioner would repeal the existing "Commissioner's Order" and would issue a new Commissioner's Order re-designating the Maury Island site as an aquatic reserve and adopting the management plan. The language in the Order would identify the boundaries of the reserve and include reference to the habitats and species identified for conservation, the management plan, and any specific lease limitations that may be imposed at the site. Additionally, the Order would state that the aquatic reserve designation would be valid for a period of 90 years, at which time the site would be re-evaluated to determine if its reserve status should continue for an additional 90-year period.

3.2.5 Program Implementation

Initially, DNR land managers would implement the management plan through the negotiation of existing and proposed use authorizations within the reserve boundary. Over time, DNR would seek reserve management funding for the site for the implementation of the more proactive provisions contained in the management plan. The plan would be reviewed and updated every ten years throughout the 90-year term of the reserve designation (in 2014, 2024, 2034, etc.). Among other issues, changes in scientific knowledge, condition of habitats and species, and existing uses would be reviewed and revised as part of the update. Additionally, data and reports generated from research and monitoring activities would be evaluated in an attempt to determine whether management actions were meeting the goals and objectives of the reserve.

3.3 Alternative 2 (Repeal the Reserve)

This alternative would repeal the existing withdrawal order and reserve designation that was established for the Maury Island site in 2000 by a Commissioner's Order. All aquatic reserve boundaries would be removed and the interim reserve management guidelines would no longer apply to the site. The 5,866 acres of state-owned aquatic tidelands and bedlands at the site currently designated as a reserve would be available for general leasing opportunities under RCW 79.90 through 79.100. This alternative would return approximately 24.4 linear miles of shoreline, extending from Neill Point to as far as the shores between Point Robinson and Luana Beach, to potential leasing "status." All future applications for use of state-owned aquatic lands at the site would still be required to comply with local, state, and federal laws as well as applicable landowner preference rights.

3.3.1 Aquatic Reserve Boundary

No lands at the Maury Island site would be designated as a reserve under Alternative 2. The area that would no longer be withdrawn or considered a reserve encompasses all of Quartermaster Harbor and the eastern shores of Maury Island up to Luana Beach, extending from the landward boundary of state ownership to a water depth of 70 feet below mean lower low water or one-half mile from the line of extreme low tide, whichever is further waterward.

3.3.2 Goals and Objectives

DNR would not adopt any site-specific goals or objectives with regards to this site. Therefore these lands would be managed following the aquatic land management guidelines that state:

> *The management of state-owned aquatic lands shall be in conformance with constitutional and statutory requirements. The manager of state-owned aquatic lands shall strive to provide a balance of public benefits for all citizens of the state. The public benefits provided by aquatic lands are varied and include: 1) Encouraging direct public use and access; 2) Fostering water-dependent uses; 3) Ensuring environmental protection; and 4) Utilizing renewable resources. Generating revenue in a manner consistent with subsections (1) through (4) of this section is a public benefit* (RCW 79.90.455).

3.3.3 Management Plan Provisions

In general, management of the Maury Island site under the Repeal the Reserve Alternative would be more passive in that DNR would primarily rely on the regulatory agencies to guide environmental protective measures for uses in the area. Management would also be reactive in the sense that DNR would likely review uses in the area primarily when evaluating applications for use authorizations and reauthorizations and little proactive management efforts would be undertaken (i.e., mooring buoy and recreational dock inventory, baseline monitoring). Further, DNR management of the Maury Island site would seek to balance public use and access, fostering water-dependent uses, utilizing renewable resources, and ensuring environmental protection, whereas with

aquatic reserve designation in place, the primary emphasis would be upon environmental protection.

3.3.3.1 Research and Monitoring

The DNR would continue to require monitoring by lessees in accordance with existing use authorization guidance and polices. Proactive research activities would not be implemented by DNR under this alternative.

3.3.3.2 Management Guidance for Existing and Future Use Authorizations

Under Alternative 2, the Maury Island site would not be managed as an aquatic reserve and no site-specific management plan would be developed. Instead, RCWs, WACs, and existing DNR guidance and procedures for use authorizations would guide management of uses at the site.

Evaluation of existing and proposed uses would be based upon the mandates for DNR management of state-owned aquatic lands, which include: encouraging direct public use and access; fostering water-dependent uses; ensuring environmental protection; utilizing renewable resources; and generating revenue in a manner consistent with the other directives (RCW 79.90.455). The DNR would encourage water-dependent uses over non-water dependent uses in accordance with RCW 79.90.460.

In general, DNR would defer to the regulatory agencies (i.e., Ecology, WDFW, Corps, and King County) in regards to facility and structure design for existing and proposed uses. However, DNR land managers would have the ability to impose additional requirements for use authorizations if deemed necessary to protect aquatic resources.

3.3.3.3 DNR Led and Partnering Activities

Under the Repeal the Reserve Alternative, DNR would not be explicitly directed to lead activities aside from those normally performed for all state-owned aquatic lands. DNR would also not be directed to partner with other entities in relation to management activities at the Maury Island site.

Derelict Vessels: The DNR would manage derelict vessels in accordance with RCW 79.100 and internal DNR guidance for the Derelict Vessel Removal Program. The DNR would not likely proactively inventory and manage derelict vessels under the Repeal the Reserve Alternative. The DNR staff would, however, respond to requests to attend to derelict vessels in the Maury Island site as time and staffing levels allowed.

Land Acquisition for Habitat: Under the Repeal the Reserve Alternative, DNR would not proactively work with local entities to identify and pursue habitat acquisition opportunities and funding sources. The DNR would respond to inquiries from external entities regarding such activities as staffing and time allowed.

Aquatic Nuisance Species Management: Under the Repeal the Reserve Alternative, DNR would utilize existing guidance and policies in the management of aquatic nuisance species on state-owned aquatic lands. Under this alternative, DNR would not plan to focus aquatic nuisance species eradication efforts in the Maury Island site, as the area is not presently thought to support large populations of aquatic nuisance species.

Transient Public Recreational Use: The DNR would promote and encourage responsible public recreational activities at the Maury Island site, as on all state-owned aquatic lands. There would be no proactive efforts to inventory uses or work with user groups to minimize potential adverse impacts of public use or to identify increased needs for access to the Maury Island site.

Outreach and Education: Under the Repeal the Reserve Alternative, DNR would not implement outreach and education activities at the Maury Island site above and beyond what is done in other areas of the state. Most often, outreach and education activities are conducted in response to specific issues. Under this alternative there would be no effort to assist local landowners with projects on their lands or to distribute BMPs for shoreline activities.

3.3.3.4 Private and Public Land Adjacent to the Aquatic Reserve

Under this alternative, DNR would not actively engage government entities or local residents regarding minimization of impacts on adjacent lands related to such issues as shoreline modification, non-point source pollution, and docks, floats, and mooring buoys on private lands. The DNR would respond to local community issues that affect state-owned aquatic lands as time and staffing allowed.

3.3.4 Commissioner's Order

Between the draft and final SEIS, DNR will prepare a Public Benefits Analysis to evaluate whether the proposed management plan would best serve the public benefit. As part of this evaluation, DNR will assess the public benefit associated with repealing the aquatic reserve status for the Maury Island site. After the SEPA process has been completed and if the Public Benefits Analysis were to find that repealing aquatic reserve status would best serve the public benefit, then the Commissioner of Public Lands would proceed to issue a "Commissioner's Order" repealing aquatic reserve designation for the Maury Island site and making the land available for general leasing activities.

3.3.5 Program Implementation

Aside from the Commissioner's Order, Alternative 2 would not require special implementation measures. The Shoreline District of DNR's Aquatic Resources Program would evaluate existing and proposed uses at the Maury Island site in the same manner as all other state-owned aquatic lands.

3.4 Alternative 3 (No Action)

Under the No Action Alternative, the Maury Island site would continue to be designated as an environmental aquatic reserve, although a site-specific management plan for the reserve

would not be developed. The No Action Alternative maintains the status quo (i.e., maintains the status of the site before the current action was considered). The objectives of the reserve would be those defined in WAC 332-30-106, which explains that environmental reserves are meant to conserve areas of environmental importance, maintain sites established for continuing environmental baseline monitoring, and/or protect areas of particular historic, geologic, or biologic interest.

3.4.1 Aquatic Reserve Boundary

The boundary for the reserve would remain the same as was originally designated in 2000, which includes state-owned aquatic lands in Quartermaster Harbor (starting at Neill Point) and the eastern shore of Maury Island, Point Robinson, and the northern shoreline toward Luana Beach (Appendix C). The site encompasses 5,866 acres of state-owned aquatic lands and extends over approximately 24.4 linear miles of shoreline.

3.4.2 Goals and Objectives

Under this alternative the goals and objectives would be those adopted for the Aquatic Reserve Program in the programmatic FEIS (DNR 2002). DNR would use aquatic reserves as a tool to help DNR ensure environmental protection, preservation and enhancement of state-owned aquatic lands that would provide direct and indirect benefits to aquatic resources in Washington State.

DNR would utilize different types of reserves to accomplish the program goal. The three types of reserves, as currently defined by WAC 332-30-151 are: environmental reserves, scientific reserves, and educational reserves. Measurable objectives for environmental reserves such as Maury Island are as follows:

- Conservation (i.e., no net loss of elements of biodiversity), ecological function and services, or historical significance; and
- Restoration (i.e., improve ecosystem function and services) and return degraded systems to better functioning conditions.
- *Associated measures to ensure environmental protection* -
  - Conduct baseline monitoring to determine if resource protection measures of designation are successful.
  - Use a checklist of key or indicator species, community and function types to measure success.

3.4.3 Management Plan Provisions

Management of the Maury Island Reserve under the No Action Alternative would be through use authorizations administered by DNR, or "by assignment to another governmental agency or institution" (WAC 332-30-151 (4)(c)).

The 2002 programmatic FEIS outlined general management actions for environmental aquatic reserves that would be used by DNR land managers in conjunction with existing RCWs and WACs to aid in determining appropriate and undesirable uses within the reserve.

However, there would be no site-specific management plan implemented under the No Action Alternative; therefore, it is uncertain whether DNR would proactively address issues relating to mooring buoys, recreational docks, trespass structures, and other components contained in the proposed management plan under the Preferred Alternative. Given time and staffing resources, proactive efforts on behalf of DNR could be undertaken, although the focus and timing of such efforts would be uncertain and subject to available resources and changing priorities.

3.4.3.1 Research and Monitoring

The DNR would continue to require monitoring by lessees in accordance with existing use authorization guidance and polices. Proactive research activities would not be implemented by DNR under this alternative.

3.4.3.2 Management Guidance for Existing and Future Use Authorizations

As per the programmatic FEIS (DNR 2002), in general, no future use authorizations would be granted that alter, remove, and/or otherwise change any existing environmental or cultural characteristic of an established reserve, except for those use authorizations that primarily serve the objectives of the reserve designation.

All uses allowed in aquatic reserves must be implemented in such a manner that would avoid, minimize, and compensate for all environmental impacts. Use authorizations that were granted prior to establishment of the reserve would be honored throughout the duration of the current leasing period.

To provide for the purpose of the reserve, the existing WAC requires "a critical review of lease applications in the reserve area to insure proposed activities will not conflict with the basis for reserve designation" (WAC 332-30-151 (6)).

In general, DNR would defer to the regulatory agencies (i.e., Ecology, WDFW, Corps, and King County) in regards to facility and structure design for existing and proposed uses. However, DNR would support maintenance and facility upgrades (for existing use authorizations within a reserve) that serve to implement the objectives of the reserve.

3.4.3.3 DNR Led and Partnering Activities

The programmatic FEIS directs DNR to work with other entities to reduce environmental impacts within the reserve but does not provide specific guidance pertaining to what types of activities should be undertaken (DNR 2002).

Derelict Vessels: The DNR would manage derelict vessels in accordance with RCW 79.100 and internal DNR guidance for the Derelict Vessel Removal Program. The Derelict Vessel Removal Program gives higher priority to derelict vessels impacting a marine protected area, such as an aquatic reserve. Therefore, assuming other variables are equal, there would be a higher likelihood that derelict vessels within the Maury Island site would be removed if the area is designated as a reserve than if it were not. However, under this alternative, there would be no specific directive for DNR to

proactively inventory potential derelict vessels within the Maury Island site. The DNR staff would respond to requests to attend to derelict vessels in the Maury Island site as time and staffing levels allowed.

Land Acquisition for Habitat: Under the No Action Alternative, DNR would not proactively work with local entities to identify and pursue habitat acquisition opportunities and funding sources. The DNR would respond to inquiries from external entities regarding such activities as staffing and time allowed.

Aquatic Nuisance Species Management: Under the No Action Alternative, DNR would utilize existing guidance and policies in the management of aquatic nuisance species on state-owned aquatic lands. Under this alternative, DNR would not plan to focus aquatic nuisance species eradication efforts in the Maury Island site, as the area is not presently thought to support large populations of aquatic nuisance species. Further, the programmatic FEIS does not include provisions specifically related to aquatic nuisance species eradication.

Transient Public Recreational Use: Transient recreational use of state-owned aquatic lands would continue in accordance with existing RCWs, WACs, and DNR guidance and policies. Access (beyond transient uses) would be limited to those individuals engaged in conservation and restoration activities at the site.

Outreach and Education: Under the No Action Alternative, DNR would not implement outreach and education activities at the Maury Island site above and beyond what is done in any other area of the state. Most often, outreach and education activities are conducted in response to specific issues. Under this alternative there would be no effort to assist local landowners with projects on their lands or to distribute BMPs for shoreline activities.

3.4.3.4 Private and Public Lands Adjacent to the Aquatic Reserve

The programmatic FEIS directs DNR to work with adjacent landowners and regulatory agencies to minimize off-site impacts but does not directly state that efforts should be made pertaining to such issues as shoreline modification, non-point source pollution, and docks, floats, and mooring buoys on private lands. Under this alternative, DNR would respond to local community issues that affect state-owned aquatic lands as time and staffing allowed.

3.4.4 Commissioner's Order

The No Action Alternative would simply maintain the status quo. Therefore, the existing Commissioner's order would remain in effect and a new Commissioner's Order would not be required for implementation of this alternative.

3.4.5 Program Implementation

The Shoreline District of DNR's Aquatic Resources Division would evaluate existing and proposed uses at the Maury Island site based upon the programmatic FEIS, in addition to

RCWs, WACs, and internal DNR guidance. No additional implementation measures would be required.

3.5 Alternatives Considered But Eliminated From Detailed Evaluation

In addition to the three action alternatives presented above, DNR also considered an alternative that would maintain reserve status for the Maury Island site and would not permit any new use authorizations in the area. Under this alternative DNR would have honored existing use authorizations but would not have re-authorized existing uses and would not consider proposals for new activities in the area. This alternative was not carried forward as it was deemed overly restrictive and was not suggested by any entities during public scoping.

4.0 Affected Environment and Impact Analysis

WAC 197-11-444 outlines the general components to be included in an Environmental Impacts Statement (EIS) and states that some or all of the identified elements may be combined to simplify the EIS format, improve readability, and focus on the significant issues. Therefore, the subsequent sections of this SEIS will address the affected environment and potential effects of the proposed action alternatives on the following resource categories:

Natural Environment: The marine environment along Maury Island is extremely complex, productive, and provides important habitat structures and ecosystem functions for a wide variety of aquatic flora and fauna. While urbanization and human development have altered much of the nearshore and marine environments in the central Puget Sound, the habitat along Maury Island remains relatively healthy, which makes it a crucial component of the area's aquatic environment. The primary components of the natural environment addressed in this SEIS include:

- Earth
- Air
- Water Resources
- Plants and Animals
- Energy and Natural Resources

Built Environment: The Maury Island site is a relatively rural area characterized by its proximity to marine waters and the natural resource, recreation, and low-density residential uses that predominate the built environment of the site. The primary components of the built environment evaluated in this SEIS include:

- Environmental Health
- Land and Shoreline Uses
- Transportation
- Public Services and Utilities

Following each description of the affected environment is a description of the potential impacts on that element of the environment. Assessing the impacts to the environment for this SEIS was constrained by four factors:

- Current information about site-specific resources is limited.
- Understanding related to science-based relationships between uses and environmental impacts is limited and expanding.
- Under the management plan, DNR would seek voluntary cooperation on behalf of adjacent landowners, recreational users, and other governmental entities to implement many proposed actions. In general, if these efforts were successful, then positive impacts to the natural environment would be increased, although participation in voluntary activities is uncertain.

- Under the management plan, DNR would work with existing and proposed authorized uses within the site to apply certain protective criteria (which are identified within the management plan) to the activities. If the criteria were met by existing and proposed authorized uses within the site, then positive impacts to the natural environment would be increased and the negative impacts to the built environment would be decreased.

Given the recognized uncertainty with these four issues, the impacts analysis attempts to determine the probability (low, moderate, or high) that the impacts would take place and whether the impacts would be:

- Positive or negative:
- Direct, indirect, or cumulative; and
- Isolated to specific locations within the reserve or dispersed throughout the reserve at-large.

The severity of the positive or negative effects of the alternatives is difficult to determine at this time, as it would greatly depend upon the degree to which the voluntary efforts are implemented and the uncertain level of future development that could be proposed at the site. Table 2 provides a summary of potential impacts from all three of the alternatives.

4.1 Earth

4.1.1 Affected Environment

4.1.1.1 Regional Overview

The Puget Sound is part of a series of interconnected, glacially scoured basins along the Pacific Coast of the northwest. Glaciers have repeatedly occupied the Puget Lowland over thousands of years. At least three, and possibly as many as six, glacial episodes have shaped the Puget Sound landscape. The most recent glaciation, called the Fraser, extended from Canada to as far south as Olympia. The Puget Lobe of Fraser episode created the north-south orientation of the Puget Sound topography and deposited the glacial till that covers much of the region (Williams et al. 2001).

The Maury Island site is located in what is generally considered the central Puget Sound basin, which encompasses the area from south of Whidbey Island down to Commencement Bay. The central basin is the largest of the Puget Sound sub-basins covering an area of approximately 290 mi² (Williams et al. 2001).

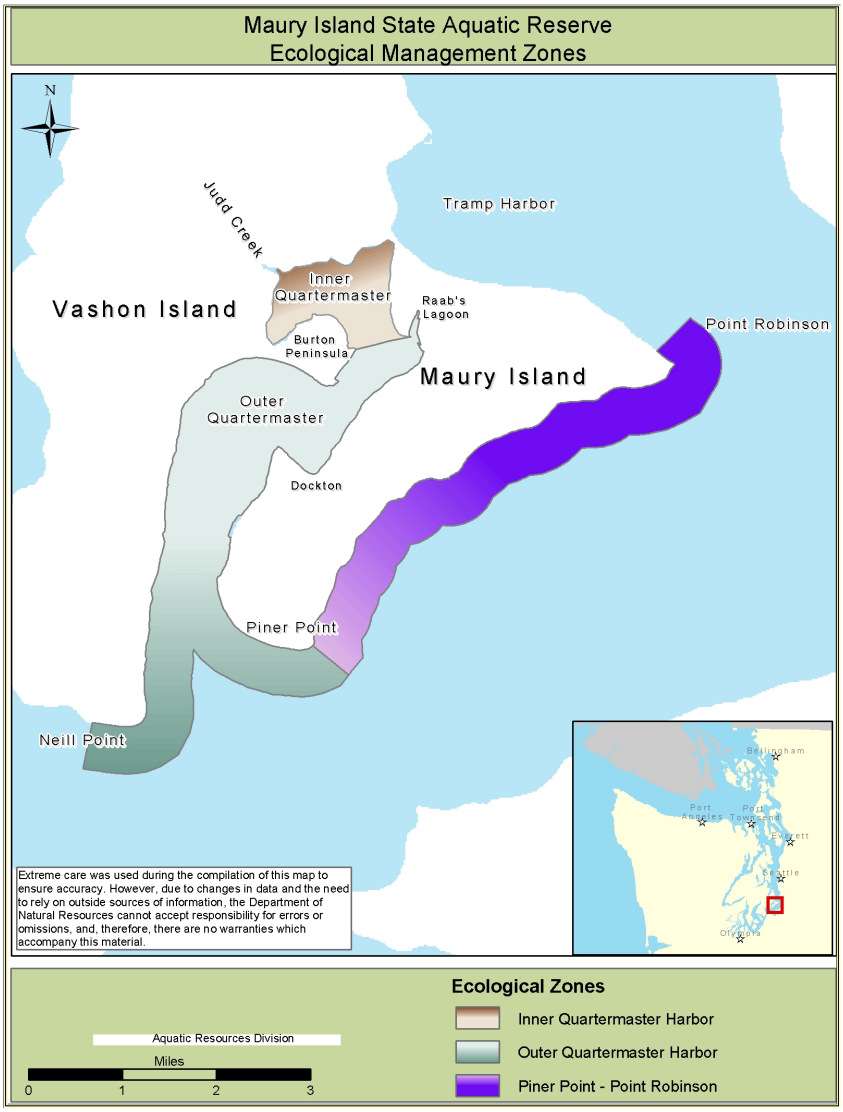
The reserve can be sub-divided into three distinct ecological management zones (Figure 2), each with substantial differences in the associated natural resources, ecological processes, and management needs. The following management units have been established for the reserve:

1. Inner Quartermaster Harbor: Inner Quartermaster Harbor is the most sheltered portion of the harbor with very weak or indeterminate currents created by tide and wind conditions (Turnbeaugh 1975). The subtidal sediments in this area are classified as mud, but the mud is much deeper than areas in outer Quartermaster Harbor (Blau 1975).

2. Outer Quartermaster Harbor: The delineation between inner and outer Quartermaster Harbor is the transition area between Burton Peninsula and Raab's Lagoon (Figure 2). With the exception of the area around Dockton, outer Quartermaster Harbor experiences much higher wave exposure, currents, and circulation. The waters in inner and outer Quartermaster Harbor are warmer, less saline, and have a higher residency time than waters offshore of Maury Island's east shore.

3. Piner Point – Point Robinson Nearshore (also referred to as the east shore of Maury Island). The east shoreline of Maury Island from Piner Point to Point Robinson is much more exposed and transitions to deeper offshore waters. Nearshore currents direct sediment movement towards the northeast, supporting the sand spit known as Point Robinson.

Figure 2: Ecological Management Zones



For a color version of this figure see http://www.dnr.wa.gov/htdocs/aqr/reserves/home.htm.

4.1.1.2 Geology and Soils

The Maury Island site is underlain by glacial till, sand, and gravel. Glacial till is a relatively unsorted mixture of clay, sand, gravel, and rocks (ranging in size from pebbles to boulders) left by receding glaciers. The source of the till in the area is from the Vashon age glacier that occupied the Puget Sound basin approximately 13,000 to 16,000 years ago. Till in the Puget Sound is often thick, sometimes 100 feet or deeper (King County 2000).

The soil and sediments near the surface of the nearshore and bedland areas of Maury Island are most likely derived from submarine erosion and glacial bluff erosion along the shoreline. In Quartermaster Harbor, tributary streams such as Judd and Fisher creeks also deliver sediments (Appendix E). While the upper intertidal substrates include mud, sand, gravel, and cobble, the lower intertidal is predominantly sandy and more than 90% of the subtidal areas within Quartermaster Harbor are classified as mud (Blau 1975). For the central Puget Sound basin as a whole, Lavelle et al. (1986) found marine sediment accumulation rates of 0.003 to 0.001 grams per square foot per year (as referenced in Williams et al. 2001). These accumulations of material, primarily from bluffs, supply fine substrates to the intertidal zone, maintaining the structure and profile typical of central Puget Sound beaches (Bloch et al. 2002).

An inventory describing parts of the Vashon and Maury Island shorelines found that approximately 88 percent of the shoreline contained bluffs or banks, with an average height of about 44 feet. The highest banks were along the southeast side of Maury Island, where the elevation at the top of the bluff is more than 300 feet at some locations (Bloch et al. 2002). The bluffs in this area are composed primarily of glacial till and are important sources of sediments for surrounding beaches (Mumford et al. 2000). The shoreline inventory found that un-vegetated scars, usually an indication of a recent landslide and potential supply of sand to beaches, were present along 41% of inventoried shoreline segments, and 36 percent had at least some undercutting at the base of the bluff or bank (Bloch et al. 2002).

After sediments enter the marine environment, shore drift is the process for material transport along shorelines. A drift cell, or littoral cell, is a partially compartmentalized zone along the coast that acts as a somewhat closed system with respect to shore drift. Drift cells are systems in which sediment is suspended by waves or currents and transported along the shoreline in a cycle of suspension and deposition. The direction of shore drift is determined by the prevailing direction of the waves and currents in the drift cell. Direction of wave approach, and the resulting shore drift, may change frequently (e.g., daily, weekly, or seasonally), but over a long period of time one of the two directions along the coast will be the primary direction of net shore drift (Schwartz et al. 1991).

Drift cells are important because they are the mechanism that supplies the sediments needed to maintain nearshore habitat quality. Drift cells nourish sand and gravel beaches, provide fine sediments to tideflats, and maintain sand spits and other coastal landforms.

The Maury Island site contains a number of individual drift cells. Along the northern shore of Maury Island, drift occurs in a southeasterly direction toward Point Robinson (Appendix D). The eastern shore of Maury Island is a continuous drift cell from Piner Point to Point Robinson, where it converges with the drift cell along the northern shoreline. The drift cell alongside the eastern shore of Maury Island is mostly uninterrupted, although sediment transport may be somewhat disturbed by existing bulkheads and fill associated with upland development. The drift of sediments within Quartermaster Harbor is primarily to the north, although there are local reversals of transport and convergence zones within the harbor where fine sediments are deposited in coves and embayments (Schwartz et al. 1991)

Sediment quality is degraded in portions of Washington's waters as evidenced by chemical contamination, toxicity, and adverse alterations to benthic infauna. In studies of sediments from the central Puget Sound, approximately 4.9 percent of the area sampled exhibited degraded or partially degraded sediment quality (Long et al. 2003). The majority of these contaminated sediments were found in highly urbanized areas such as Elliott Bay. Sediment quality has been assessed for Quartermaster Harbor at a coarse scale as part of a regional assessment (Newton et al. 2002). None of the three samples within Quartermaster Harbor showed high chemical concentrations, and one of the three stations showed no toxicity or chemical contamination and abundant and diverse infaunal assemblages. The other two stations were impaired for one of the three parameters – toxicity (Newton et al. 2002). Examinations of groundfish tissue samples from Quartermaster Harbor found little contamination, suggesting that sediments in the area are relatively clean. Elevated concentrations of mercury and Polychlorinated Biphenyls (PCBs) were found in flounder samples, although the concentrations were similar to other non-urban bays in the central Puget Sound basin (Crecelius et al. 1989). Upland soils on Vashon and Maury Islands are contaminated with arsenic, lead, and other metals in the area downwind from the former Tacoma Copper Smelter (Glass 2000). It is unclear what, if any, impacts this contamination has on the freshwater or saltwater sediments associated with the aquatic reserve. No exceedences of state criteria for sediment toxicity or chemical concentrations have been reported at the Maury Island site.

4.1.2 Impact Analysis

4.1.2.1 Alternative 1 (Preferred Alternative)

The Preferred Alternative would have a moderate probability of causing positive direct impacts to geology and soil resources at discrete locations throughout the site.

The reserve may affect: a) sediment dredging or disturbance; b) sediment contamination; and c) sediment erosion and movement rates. Apart from federal navigation projects, dredging would not be allowed within the Aquatic Reserve for navigation or beneficial use projects. Additionally, sediment disturbance would be minimized or eliminated through best management practices adopted in the management plan including the practice of drilling beneath the surface to install pipelines or cables within the nearshore zone.

This alternative has the potential to maintain and restore natural sediment erosion and movement rates. The natural process of shoreline drift, which redeposits sediments along the shoreline, will benefit from public education and best management practice development that will affect the presence of, and construction methodology used in, shoreline armoring. Traditional "hard" structures such as riprap or concrete walls disrupt drift cell processes by increasing wave energy and preventing the deposition of finer grained materials used for forage fish spawning and macro-invertebrate habitat (Williams and Thom 2001). Over time the increased wave energy may actually heighten erosion rates by undercutting the bulkhead and removing finer grained particles at the base of the embankment. In contrast, "soft" armoring techniques that DNR would promote such as beach nourishment[2], riparian plantings and the use of anchored drift logs mimic natural processes improving bank stability while enhancing habitat processes (Menashe 2001; Williams and Thom 2001).

While the DNR has no direct control over armoring processes, in section E-102a of the 2004 proposed amendments to the King County Comprehensive Plan, the County states that it "...**shall** protect and **should** enhance the natural environment in those areas designated as Aquatic Reserves by the Washington State Department of Natural Resources." (emphasis added) (King County 2003). Upon adoption of the 2004 amendments, King County and DNR could work cooperatively with interested landowners to voluntarily develop, fund, and implement soft armoring solutions within the Maury Island site.

Finally, DNR would avoid future contamination to soils by requiring the use of construction materials that will not leach hazardous chemicals into the water for construction and repair activities on state-owned aquatic lands in the reserve.

4.1.2.2 Alternative 2 (Repeal the Reserve)

Alternative 2 would have a low probability of causing negative direct impacts to geology and soil resources at discrete locations throughout the reserve. As in Alternative 1, however, repealing the proposed reserve would have no impact on the underlying structure or composition of the site's overall geology.

By repealing the proposed reserve there would be no comprehensive effort to prevent alteration of drift cell processes through bulkheading unless undertaken by King County in association with their shoreline management regulations. It can be expected that as shoreline residential development increases, the number of bulkheads may also increase, leading to a loss of the finer grained sediments utilized for spawning habitat by forage fish, which could lead to population decreases. In addition, King County would be solely responsible for the development and implementation of less destructive armoring solutions.

[2] Beach nourishment is a technique used to restore an eroding or lost beach or to create a new sandy shoreline. The technique involves the placement of sand fill with or without supporting structures along the shoreline to widen the beach. This management tool serves the dual purpose of protecting adjacent upland and preserving beach resources.

4.1.2.3 Alternative 3 (No Action)

Alternative 3 would have a low probability of causing positive direct impacts to geology and soil resources at discrete locations throughout the reserve. As is in the previous two alternatives, leaving the reserve status in place without developing a proactive management plan would have no impact on the underlying structure or composition of the site's overall geology.

As in Alternative 2, under Alterative 3 there would be no comprehensive effort to prevent alteration of drift cell processes from bulkheading unless undertaken by King County in association with their shoreline management regulations. It can be expected that as shoreline residential development increases, the number of bulkheads may also increase, leading to a loss of the finer grained sediments utilized for spawning habitat by forage fish, which could lead to population decreases. In addition, fewer entities would be responsible for the development, funding and implementation of less destructive armoring solutions. Given that the reserve designation would remain intact and more scrutiny would be placed on proposed uses within the reserve (under the programmatic FEIS, existing RCWs, and WACs), restrictions that DNR may include in use authorizations could protect nearshore drift cells and tidelands that are owned by the state. Unlike Alternative 1, no effort would be undertaken to reduce impacts to nearshore drift by existing structures located on state-owned aquatic lands within the reserve.

4.2 Air

4.2.1 Affected Environment

The topography of the Puget Sound constrains air movement and primarily directs wind in a north-south orientation. From October through March the flow is predominantly from the southwest. Through the spring, wind flow gradually reverses direction until it is generally from the north. Highest monthly wind speeds normally occur when the wind is coming from the south, with velocities ranging from 13 mph (6 m/sec) to 20 mph (9 m/sec). When wind is directed from the north, wind velocities are generally lower in the range of 11mph (5 m/sec) to 16 mph (7 m/sec). Winds in the Puget Sound do not tend to show a significant sea breeze effect (Williams et al. 2001).

There is no recent site-specific air quality data for the Maury Island site. Between 1890 and 1985 air quality throughout the reserve area was negatively impacted by a copper and arsenic smelter located in Tacoma. Closure of the smelter in 1985 resulted in measurable declines in sulfates and arsenic as far away as the Canadian border (Faulkner 1987). Monitoring conducted in the late 1970s through the 1980s demonstrated that ambient air quality was within the current standards for particulates, sulfur dioxide, and lead. No information was available for carbon monoxide, ozone, or nitrogen dioxide (Puget Sound Clean Air Agency 2004).

4.2.2 Impact Analysis

4.2.2.1 Alternative 1 (Preferred Alternative)

The Preferred Alternative would have a low probability of causing positive indirect and cumulative impacts to air quality in and around the site. Neither designation of an

aquatic reserve boundary nor implementation of a reserve management plan for the Maury Island site would directly impact air quality at the location.

Air quality may improve as a result of fewer commercial vessel visits to the reserve area and a decreased likelihood that water-dependent industrial enterprises would locate adjacent to the reserve. Use authorizations issued by DNR for certain activities could result in localized changes in air quality. For example, the issuance of a lease for a marina could indirectly lead to localized increased emissions from burning fossil fuels associated with boat motors. DNR may impose some restrictions or request that BMPs be implemented for activities, such as marinas, that may indirectly cause positive impacts to air quality in the area. However, the magnitude of such impacts would be small and would not be expected to significantly contribute to regional air quality. Furthermore, the management of air quality is not within the jurisdiction of DNR.

There is also a low probability of causing negative indirect and cumulative impacts to air quality beyond the site. Projects that are not allowed to occur within the aquatic reserve may be forced to locate at alternative locations that could increase the transportation distance for raw materials or finished products. This increased transit distance would likely result in adverse air quality impacts due to increased emissions.

4.2.2.2 Alternative 2 (Repeal the Reserve)

Alternative 2 would have a low probability of causing negative indirect and cumulative impacts to air quality in and around the site, although repealing the reserve designation would not directly impact air quality in the area.

As discussed above for the Preferred Alternative, DNR use authorizations could indirectly impact air quality through emissions from permitted activities. If there were no greater scrutiny placed on DNR use authorizations under a reserve management program, uses taking place on the site could cause some negative impacts to air quality in specific locations.

4.2.2.3 Alternative 3 (No Action)

The No Action Alternative would have a low probability of causing positive indirect and cumulative impacts to air quality in and around the site. Maintaining the reserve designation without formulating a site-specific management plan would not directly impact air quality in the area.

As discussed above for the Preferred Alternative, DNR use authorizations could indirectly impact air quality through emissions from permitted activities. Given that the reserve designation would remain in tact and more scrutiny would be placed on proposed uses within the reserve (under the programmatic FEIS, existing RCWs, and WACs), DNR may include provisions within use authorizations that could indirectly benefit air quality. Since there would be no standardized provisions, these positive impacts would be less likely, and may be less profound, than under the Preferred Alternative.

4.3 Water Resources

4.3.1 Affected Environment

4.3.1.1 Marine Water Resources

The Puget Sound is a large estuary, where fresh and marine waters mix. Estuarine waters function as a partially blended, two-layer system, with less saline surface waters flowing seaward and denser, more saline ocean water returning landward at lower depths. Surface water flows can be augmented by inflow from any number of rivers and streams throughout the estuary. While there are several large rivers and a multitude of smaller streams in the general region, the bulk of the freshwater flowing into the central Puget Sound basin comes from the Puyallup and Duwamish Rivers, which account for 20 percent of the total drainage area. Tidal energies in the central basin are relatively strong and the water mixes freely throughout most of the year. However, during summertime dry seasons, stratification increases as freshwater inputs decrease (Williams et al. 2001).

The accumulated data indicate that Quartermaster Harbor is subject to wide seasonal fluctuations of most water quality parameters and is typical of a shallow Puget Sound embayment with a relatively high ratio of drainage area to receiving water (NORTEC 1984). An estimated 61 streams and outfalls empty into the Maury Island site with the majority draining into Quartermaster Harbor (Anchor Environmental 2004). Seasonal variations are driven primarily by rainy winters and dry summers common to the Pacific Northwest. The wetter winter period causes marked declines in salinity, pH and temperature, while coliform bacteria levels increase (NORTEC 1984; Turnbeaugh 1975). While vertical salinity gradients are generally present within Quartermaster Harbor, observations vary in how pronounced these gradients are with Turnbeaugh (1975) noting more pronounced gradients than NORTEC (1984).

Quartermaster Harbor is a rather shallow embayment that covers approximately 3,050 surface acres with water depths in the inner harbor averaging about 16 feet, while in the outer harbor water depth averages approximately 72 feet and reaches maximum depths of about 100 feet (Nortec 1984). Circulation within the harbor may be reduced due to the closure of a historic opening at Portage, however circulation appears to be adequate to flush Quartermaster Harbor (Turnbeaugh 1975). An area of "less active" circulation is located between Judd Creek and Burton Peninsula. Historically, water flowed freely in and out of the harbor during high tides through an inlet known locally as Portage, located between Maury and Vashon Islands. Portage, is an isthmus connecting Vashon and Maury Islands. While George Vancouver's initial observations of the islands in 1792 indicate only one island, Captain Charles Wilkes charted two islands in 1841 (Lynn 1974). The opening was closed through the construction of two roads, one from Portage to Ellisport in 1916 and another from Portage to Dockton in 1925 (Van Olinda 1935). Current water movement is primarily northward into the harbor. While water quality impacts resulting from the complete enclosure of Quartermaster Harbor are not fully understood, the decrease in flushing may have led to an increase in the harbor's water temperature regime and may be contributing to eutrophication (Williams et al. 2000).

Water quality within the harbor has been adversely impacted by a number of human-related sources, including: residential septic systems; residential landscaping; gray water discharges from residences and/or boats; historic industrial activity; and both current and historic agricultural practices in watersheds surrounding the Maury Island site. In addition, elevated fecal coliform pollution and episodes of paralytic shellfish poisoning (PSP) have led to the decertification of several shellfish harvest areas within Quartermaster Harbor (Determan 2003b; WDOH 2004).

The Washington State Department of Health (WDOH) monitors Quartermaster Harbor for fecal coliform to assess whether fecal waste is reaching the water and to determine whether pollution levels could be pathogenic. Recent reports suggest that shellfish growing areas in Quartermaster Harbor are not being impacted by fecal coliform pollution (Determan 2003a).

However, in both 2001 and 2002 Quartermaster Harbor had one of the highest index scores for PSP. Index scores are based upon the number of days PSP levels at the site exceed the Food and Drug Administration (FDA) action criteria as well as the magnitude by which PSP levels exceed FDA action criteria (Determan 2003b). PSP is the result of a toxin that accumulates in marine animals that feed either directly on toxic phytoplankton or on consumers of toxic phytoplankton. As there is considerable uncertainty associated with the causative agent of PSP, it is not possible to determine whether its presence in Quartermaster Harbor is brought about by disturbed nutrient cycles in the area or by regional phenomena outside of the harbor. Although shellfish health is unaffected by the presence of the toxin, PSP is capable of causing mass mortalities among shellfish-eating animals such as birds, fur seals, foxes, sea otters, and humpback whales (Kvitek and Beitler 1988; Geraci et al. 1989). In addition, PSP can be harmful to humans that consume toxic shellfish. Due to concerns regarding fecal coliform levels and PSP, commercial geoduck tracts along the western shoreline of Quartermaster Harbor have been decommissioned (Appendix I).

Based upon uses in the area, the Department of Ecology (Ecology) considers the waters within the Maury Island site as "extraordinary" (WAC 173-201A-210). Such waters have the most stringent water quality standards. There is limited water quality data for Quartermaster Harbor, although sampling conducted in the area was sufficient to prompt Ecology to include the embayment on the 1998 Washington State 303(d) list for violating state water quality standards for dissolved oxygen (DO) and dieldrin (Ecology 1998).

Infrequent water quality sampling indicates that low DO conditions may be widespread and persistent within Quartermaster Harbor. In 1975, October observations found DO levels varied between a low of 3.80 mg/L at 16 feet deep within inner Quartermaster harbor to a high of 6.30 mg/L at 25 feet deep near the mouth of Quartermaster Harbor (Turnbeaugh 1975). All fifteen Quartermaster Harbor observations from 1975 were below the extraordinary standard of 7.0 mg/L. Sampling in September 1982 found low DO levels (5.6 mg/L at 4 meters and 3.5 mg/L at 5

meters) at only one sampling station located between Judd Creek and Portage. February 1983 observations found that in addition to low DO at this sampling station (6.7 mg/L at 5.5 meters depth), one additional station, located near the Quartermaster Harbor Marina, also had low DO levels (6.6 mg/L at 4.5 meters). September 1983 observations found that low DO conditions were widespread within Quartermaster Harbor at depths of 5 meters or more with all sampling stations showing low DO conditions at or deeper than 5 meters (NORTEC 1984). As a result of chronic low DO levels, the harbor was placed on the 303(d) list in 1998. However, Ecology recognizes that the low DO levels observed were likely due to natural conditions. Under state water quality standards, in waters where low DO is a natural occurrence, human – induced activities must not degrade waters by more 0.2 mg dissolved oxygen/L (WAC 173-201A-320).

Dieldrin is an insecticide that bioconcentrates in aquatic organisms and causes permanent hormonal changes in fish. While acute exposure in humans can lead to neurological effects such as headache, dizziness, and convulsions, the effects have not been shown to be permanent (GPA 2001). However, chronic exposure will lead to dieldrin bioaccumulation in humans and may be fatal (GPA 2001). Dieldrin readily binds to soil particles and as a result is persistent and widespread in the environment. The Washington State standard for acute concentrations of dieldrin in marine waters is 0.71 µg/L or higher, with the chronic level 0.0019 µg/L or higher. Tissue samples from fish in Quartermaster Harbor have been found to exceed the acute criteria for dieldrin.

Section 303(d) of the federal Clean Water Act (CWA) requires that states keep an inventory of water bodies that violate water quality standards and that total maximum daily loads (TMDLs) be established for each parameter that is in violation of the standards. Ecology is currently updating the 303(d) list. Ecology's recent draft 303(d) update for 2004 suggests that Quartermaster Harbor will not be included on the list (Ecology 2004). However, the site conditions have not necessarily improved and the site is being removed from the 303(d) list because no recent monitoring has taken place.

Along the eastern shore of Maury Island, water depth increases rapidly across moderate to steep slopes to approximately 540 feet (152 meters) in the main channel of southern central Puget Sound (Williams et al. 2000). This reach of shoreline is considered semi-protected, with lower wave energy than other locations in the Puget Sound region. The northerly transport of surface waters along the shoreline is believed to concentrate plankton and nutrients along the beach, providing relatively high levels of primary production.

No information was found pertaining to water quality sampling along the eastern shore of Maury Island, although the waters in the area are considered "extraordinary" and are therefore subject to the most stringent state standards.

4.3.1.2 Freshwater Inputs

An estimated 61 streams and outfalls empty into the Maury Island site with the majority draining into Quartermaster Harbor (Anchor Environmental 2004). Larger, perennial streams on Vashon and Maury islands generally originate from groundwater seeps in higher elevation areas (300 to 500 feet above sea level). In these higher elevation reaches, the streams are typically low gradient and meander across the landscape. Streams approaching marine shorelines change elevations rapidly as they flow through a network of high-gradient ravines before entering Quartermaster Harbor. Streams with lower flows and smaller watershed areas generally originate in steeper gradient reaches (10 to 15 percent) and flow rapidly to marine waters (Kerwin and Nelson 2000).

Maury Island is not divisible into watersheds, and it appears that the majority of freshwater flow from the island enters Quartermaster Harbor through intermittent creeks and freshwater seeps. Two watersheds flow into Quartermaster Harbor from Vashon Island through Judd and Fisher Creeks (Appendix E). Judd Creek has an annual base flow of approximately 2.0 cubic feet per second (cfs) at the mouth and drains about 3,149 acres. Fisher Creek has an annual base flow of approximately 1.0 cfs, with a drainage area of about 1,549 acres (Kerwin and Nelson 2000). Limited water quality monitoring was undertaken in these tributaries in the early 1990s and Judd Creek was found to comply with all state standards. Although several samples from Fisher Creek exceeded the acute standard for lead, the Creek was within limits for all other parameters (Kerwin and Nelson 2000). The Burton Water Company withdraws water from Fisher Creek for domestic use, which may limit baseflows during low flow periods.

Upland land use and vegetation adjacent to marine shorelines affect the habitat quality of marine systems by affecting food sources such as the insect assemblages and freshwater hydrology. Perhaps the single most dramatic and pervasive impact of urbanization on the functions and values of a watershed is the replacement of the natural landscape with pavement and other water-impervious (impenetrable) material such as roads, parking lots, driveways, sidewalks, and rooftops. Increased levels of impervious surfaces interrupt the hydrologic cycle, alter stream structure, and degrade the chemical profile of the water that flows through streams. These changes affect fish and wildlife in various ways, and are cumulative within watersheds. Research indicates that when the total impervious area (TIA) in a watershed reaches 10 percent, stream ecosystems begin to show evidence of degradation (Booth and Jackson 1997). Only one of the four watersheds adjacent to the Maury Island site approaches 10 percent total impervious area - East Vashon (King County 2003). A total of approximately 1,460 acres within these four watersheds has been converted into impervious surfaces. The concentration of houses and roads near marine shorelines has resulted in a higher proportion of lands converted into impervious surfaces near the marine shorelines. Adjacent to the aquatic reserve, 16.9 percent of the lands within 200 feet of the marine shoreline are classified as impervious. It is generally recognized that ecological effects become severe as total impervious area approaches

30 percent in stream systems (Schueler 1994; Arnold and Gibbons 1996; Booth and Jackson 1997), but the impacts on marine systems are poorly understood.

Freshwater seeps along the marine shoreline are known to exist, but the number of seeps and the amount of water entering the reserve through freshwater seeps is unknown.

4.3.2 Impact Analysis

4.3.2.1 Alternative 1 (Preferred Alternative)

The Preferred Alternative would have a moderate probability of causing positive direct, indirect, and cumulative impacts to water quality in and around the site. While DNR does not regulate the water column, benefits may accrue through management of marine outfalls and structures that impact water circulation. Therefore, the Preferred Alternative would benefit both marine and freshwater resources.

The draft management plan identifies four mechanisms that are likely to improve water resources. These mechanisms include: a) increased monitoring and scrutiny of water quality measurements; b) enhanced monitoring and focus on maintaining natural freshwater flow and hydrology; c) prohibition of new stormwater or sewage outfalls on state-owned aquatic lands within Quartermaster Harbor; and d) cooperative efforts to minimize existing and future impacts from outfalls and runoff discharging into the reserve. Regular monitoring and improved understanding of natural hydrologic cycles within the reserve may help prevent extremely low DO and toxic events from occurring. Partnerships developed with King County and Ecology in support of the reserve could prevent further degradation of water and sediment quality by limiting chemical nutrient and other chemical inputs from terrestrial development. In addition, implementation of best management practices for marinas, recreational docks, and mooring buoys would improve water quality by limiting the types of open water discharges that occur.

4.3.2.2 Alternative 2 (Repeal the Reserve)

Alternative 2 would have a moderate probability of causing negative direct, indirect, and cumulative impacts to water quality in and around the site. Repealing the reserve would likely reduce DNR's activities aimed at improving the quality of water resources of the site through the implementation of best management practices for marinas, recreational docks, and mooring buoys, among other activities. Since DNR has no direct control over water quality or quantity, any improvement would be the result of increased regulation by either King County or Ecology. In light of limited financial resource for both King County and Ecology, along with increased development pressures, it is likely that water resources would degrade over the short term.

4.3.2.3 Alternative 3 (No Action)

Alternative 3 would have a low probability of causing positive direct, indirect, and cumulative impacts to water quality in and around the site.

Without a management plan, there would be no specific guidance for DNR land managers to help to ensure that uses such as marinas, recreational docks, and mooring buoys utilized best management practices to protect water quality in the area. Instead the prevention of degradation to either water quality or quantity would be limited to efforts undertaken by King County or the Department of Ecology. Given, however, that the reserve designation would remain intact and more scrutiny would be placed on proposed uses within the reserve (under the programmatic FEIS, existing RCWs, and WACs), restrictions that DNR may include in use authorizations could protect water quality, but not in a predictable manner.

4.4 Plant and Animal Resources

Washington's SEPA defines plant and animal resources in a manner that includes habitat, unique species, and fish or wildlife migration routes. Within its authority to authorize uses on state-owned aquatic lands, DNR can allow uses that may impact these plant and animal resources. Before addressing possible impacts caused by a Maury Island Aquatic Reserve, it is important to state that DNR does not have complete control over all activities that take place on state-owned aquatic lands. As such, activities may take place within and outside of reserves that DNR cannot control. These activities may contribute to the degradation of plant and animal resources regardless of DNR's management efforts. The significant adverse impacts that may result from the three alternatives are described under Impacts Analysis at the end of this section.

4.4.1 Affected Environment

4.4.1.1 Fisheries

A large diversity of recreationally, and commercially important fish species do visit and spawn within the Maury Island site (Miller and Borton 1980). However, it is important to note that most of these fish species do not occur continuously or even frequently within the reserve (Blau 1975). Quartermaster Harbor has supported a limited commercial fishery for Pacific herring (*Clupea harengus pallasi*), pile perch (*Rhacochilus vacca*), and surf smelt (*Hypomesus pretiosus pretiosus*) (NORTEC 1984). While these fisheries appear to have declined from their historic highs, commercial fishing still occurs in the vicinity of Quartermaster Harbor. Records indicate that the largest pile perch (3 pounds, 9 ounces) and striped surfperch (*Embiotoca lateralis*) (2 pounds, 1 ounce) caught in Washington State were caught in Quartermaster Harbor in 1980 and 1981, respectively.

Several studies assessing the health of Commencement and Elliot bays have sampled Quartermaster Harbor to serve as control samples (e.g., Malins et al. 1997; Gibson et al. 2000). Compared to the urban bays, samples from Quartermaster Harbor contained a lower abundance of fish, however these samples contained significantly more species and more biomass (Gibson et al. 2000). Thus, although fewer fish are observed, individual fish tend to be larger. Additionally, almost every fish species found in both urban bays and Quartermaster Harbor were significantly larger within Quartermaster Harbor. These studies identified sensitive species that are more common or significantly larger in the reference areas (Quartermaster Harbor) than in the urban bays. These species include: Spiny dogfish, spotted ratfish, longnose skate,

rock sole, starry flounder, speckled sanddab, pile surfperch, striped surfperch, bay goby, blackbelly eelpout, bay pipefish, and plainfin midshipman (Gibson et al. 2000).

Salmonids: Adult and juvenile salmonids, particularly Chinook, chum, and the anadromous form of cutthroat and rainbow trout, have all been documented as occurring in, and dependent upon areas within the Maury Island site. The nearshore environment is also vital to the plant and animal communities upon which salmonids depend. While salmonids exhibit a wide range of specific life histories, there are several requirements that are common to all salmon and trout.

Common Life History Requirements: Although anadromous Pacific Northwest salmonids spend the majority of their life maturing in the open ocean, estuaries (such as Puget Sound) and freshwater systems are critical for adults and juveniles. Spawning adults utilize cold water streams and rivers (7° to 18° Celsius) with substrates comprised of loose, silt-free gravel for redds. Substrate size is important not just for spawning, but as shelter for fry and as a diverse source of food from aquatic invertebrates. Spawning substrates generally range from about one inch in diameter up to about six inches in diameter (Raleigh et al. 1986). Complex, meandering channels with stable flows provide a network of riffles, pools, and side channels for shelter and juvenile rearing. Juveniles are also dependent upon relatively high dissolved oxygen content (≥ 7.0 mg/L).

All salmonid life stages benefit from native riparian vegetation that provides shading and cooler water temperatures, as well as a source of food from terrestrial insects, and shelter under/in large woody debris. Upland land use can be an indication of riparian habitat condition adjacent to the shoreline. Approximately 43 percent of the land within 200 feet of the marine shorelines adjacent to the Maury Island site is classified as either Urban/High Density (6 percent) or Mixed Urban/Low Density (37 percent) (King County 2002). The rest of the lands are classified as forested, shrub vegetation, or herbaceous vegetation. Washington DNR classified approximately 28 percent of the shorelines adjacent to the Maury Island site as containing 'riparian vegetation' during the ShoreZone Inventory (Nearshore Habitat Program 2001). These data suggest that urban land pressures exist adjacent to the Maury Island site and have affected between 43 and 72 percent of the shoreline habitats. Due to the concentration of activities near the marine shoreline these developments may be adversely impacting habitats and natural ecological processes that support the local aquatic ecosystem.

There are four diverse life histories among salmonids – adfluvial (spawn in streams, rear and mature in lakes); fluvial (spawn in natal streams but migrate to larger rivers for rearing and maturation); resident (remain in natal stream through all life stages); and anadromous (spawn and rear in streams, rear and mature in saltwater). The majority of Puget Sound salmonids exhibit the anadromous life history pattern (Wydoski and Whitney 2003). In addition to this variation in life history, salmonids also display a great deal of diversity in terms of juvenile freshwater residency and age at sexual maturity. Juvenile freshwater residency can range from a few weeks up to

several years, while the age at sexual maturity generally ranges from about two to six years (Wydoski and Whitney 2003).

Chinook Salmon (Oncorhynchus tshawytscha): Chinook, or king salmon, are anadromous and the largest of the Pacific salmon species (Myers et al. 1998). The species' eastern historic range extends from the Ventura River in California, to Point Hope in Alaska, and westward to northeastern Asia and northern Russia (Healey 1991). The Puget Sound Chinook evolutionarily significant unit (ESU) was listed as threatened under the federal Endangered Species Act (ESA) by the National Oceanographic and Atmospheric Administration – Fisheries (NOAA – Fisheries) in March of 1999 and includes runs from the North Fork Nooksack River in northeast Puget Sound to the southern Puget Sound watersheds, Hood Canal, and the Strait of Juan de Fuca.

Chinook salmon display two distinct races (ocean and stream-type), with ocean-type fish spending a lesser amount of time in freshwater (Myers et al. 1998). Generally, ocean-type Chinook juveniles outmigrate either as fry during their first spring or fall, or as yearling juveniles during their second spring depending on environmental conditions and local adaptations, while stream-types spend one to two years in freshwater (NMFS 2003). Ocean-type Chinook also tend to remain nearer the coastline throughout their marine residence, with return timing varying from spring to winter depending upon local adaptations, but concentrated in the fall. Stream-type Chinook exhibit extensive offshore ocean migration and usually return to freshwater to spawn in spring or summer (NMFS 2003; Myers et al. 1998).

The Puget Sound Chinook salmon ESU is thought to be primarily comprised of ocean-type fish displaying a fall run timing. Fall run Puget Sound Chinook normally return to freshwater in July and August and spawn from September through January, while spring Chinook return to freshwater in April and May and spawn from August through September (Myers et al. 1998). Chinook spawning can occur in streams as small as seven feet wide, although they generally prefer to spawn in larger mainstem habitats. Spring Chinook spawn in middle and upper mainstem reaches, while fall run fish tend to spawn in lower mainstem areas (Cramer et al. 1999).

Both spring and fall run Chinook fry emerge from the gravel during February and March, with the majority of the fall run progeny outmigrating within 60 to 150 days after emergence (Cramer et al. 1999). Chinook fry prefer the lower velocity margins of streams, with fall Chinook moving steadily downstream to the estuary, where they normally spend several months rearing. Streamside and marine riparian habitat provides important cover in the form of wood, root wads, overhanging vegetation, and undercut banks (Healey 1991).

After moving into salt water, Puget Sound Chinook generally migrate north along the Canadian coast, but some fall Chinook spend their entire marine residence within Puget Sound. Ocean-type Chinook generally remain at sea from one to six years before they mature, with most spending two to four years in the ocean before returning to their natal streams to spawn (Wydoski and Whitney 2003).

Myers et al. (1998) estimated an approximate run size of 690,000 Chinook in Puget Sound at the beginning of the 20th century[3] when hatchery production was negligible, compared to a recent average run size of approximately 240,000, the majority of which is from hatchery production. An estimated two billion hatchery Chinook have been released into Puget Sound tributaries since the 1950s (Myers et al. 1998) and hatchery returns account for approximately 57 percent of the total spawning escapement (NMFS 2003).

Sampling has documented juvenile Chinook salmon along the shorelines of Maury Island and within Quartermaster Harbor. Data from these samples suggest that fish found in this area arise from one of several watersheds with Chinook salmon caught from the following hatcheries: Wallace River Hatchery (WRIA 7), Soos Creek Hatchery (WRIA 9), White River Hatchery (WRIA 10), Hupp Springs Rearing (WRIA 15) (Brennan and Higgins 2004). The presence of Chinook salmon from a number of different areas rearing along the shorelines of Vashon and Maury Islands suggest that that juvenile Chinook readily cross open water to reach the island.

While there are suggestions that Chinook may have been observed in the lower reaches of Judd Creek, Brennan and Higgins (2004) suggest that there are no Chinook producing streams or hatchery releases of Chinook on Vashon or Maury islands. Juvenile and adult Chinook have been documented as using the shallow water habitats of Quartermaster Harbor for rearing. These fish prey on the forage fish that inhabit Quartermaster Harbor and the surrounding areas. The eastern shoreline of Maury Island is also an important migration corridor, as Chinook smolts tend to remain in the nearshore environment as they migrate out of the Puget Sound. Brennan and Higgins (2004) found that vegetated shoreline habitats are an important source of juvenile salmon with juvenile diets numerically dominated by insects characteristic of terrestrial vegetated habitats such as Psocoptera (bark lice), Homoptera (aphids, plant hoppers), and Hymenoptera (ants).

Puget Sound Chum Salmon (Oncorhynchus keta): The majority of chum stocks in the Puget Sound are fall runs, although summer and winter stocks also exist. In 1993, the Washington Department of Fisheries identified forty-five fall chum populations in Puget Sound, including nine in the northern area (Canada-Washington border to the Stillaguamish River), thirty in the southern area (Snohomish River watershed south and Hood Canal), and six in the Strait of Juan de Fuca (Washington Department of Fisheries et al. 1993). The status was *unknown* for thirteen of these populations and *healthy* for all others. Hood Canal populations of summer chum were listed as threatened in 1999 under the federal ESA by the NOAA – Fisheries.

Although fall chum runs fluctuated between roughly 156,000 to more than 2.4 million fish from 1968 to 1999, the average runs for the period were between one and almost 1.5 million fish. Unlike other salmonid stocks, chum populations have exhibited a

[3] This estimate, as with other historical estimates, should be viewed with caution. Fish landings used in this calculation included a portion of fish landed at Puget Sound ports but originating in Canada and other areas outside Puget Sound, and the estimates of exploitation rates used in run-size expansion calculations may not be based on precise data (Myers et al. 1998).

positive trend since the late 1960s. Approximately 37 percent of the total Puget Sound run originates in the Hood Canal, 33 percent in South Puget Sound, 29 percent in North Puget Sound, and just one percent in the Strait of Juan de Fuca (WDFW 2003a).

Chum are anadromous and generally mature between three and five years of age, with a high proportion of Washington stocks maturing at age three. Spawning of fall chum primarily occurs from October through January, while winter chum generally spawn from mid-December through early March (Johnson et al. 1997).

Young-of-year emerge between February and June and migrate quickly to the estuary where they rear for several months before migrating out of the Puget Sound. Eelgrass beds are extremely important for rearing chum salmon, with two species of copepods that make up a large portion of the juvenile's diets found only in eelgrass (Simenstad et al. 1988). Upon leaving Puget Sound, Washington chum generally migrate northward along the coast with their path being closer to shore than coho, Chinook, or steelhead. Chum rear at sea for two to four years before returning to their natal streams to spawn.

From 1991 through 2000, an average of more than 5.1 million hatchery chum salmon per year were released into Puget Sound. Of these, approximately 91 percent were fall chum and one percent were winter chum (Pacific States Marine Fisheries Commission 2002).

While there is no data regarding total abundance of chum at the Maury Island site, both juveniles and adults have been documented in the area. In addition to juveniles using the nearshore for rearing habitat, the WDFW Spawning Ground Survey Database indicates that fall chum spawn in the lower reaches of Judd Creek (Kerwin and Nelson 2000). It is not known whether these fish originated from these streams, or whether they are the progeny of strays from other systems or hatchery plants.

Puget Sound Coho Salmon (Oncorhynchus kisutch): Coho salmon were historically distributed along the Pacific coast from Mexico to Alaska and from Russia to Japan (Scott and Crossman 1973). The NOAA – Fisheries designated the Puget Sound coho salmon ESU as an ESA candidate species in 1995 although listing as a threatened or endangered species is not considered prudent at this time.

Most coho in Washington, Oregon, and California spend the first year of their lives in freshwater and return to spawn in their third year, although some precocious males return to spawn at age two (Wydoski and Whitney 2003). The Puget Sound spawning migration begins in August, with spawning generally occurring from September through January (Weitkamp et al. 1995). Wild coho tend to spawn in smaller rivers and tributaries or side channels of larger systems, with fry emerging within six to eight weeks (Wydoski and Whitney 2003).

Weitkamp et al. (1995) noted that while populations of the Puget Sound coho ESU are abundant and that runs and natural spawning escapements are generally stable,

there are substantial risks to the remaining native stocks. Although coho are remarkably adaptable and can be found spawning in significantly degraded streams, wild populations continue to decline as a result of habitat loss from human development (Wydoski and Whitney 2003).

Presently, most coho returning to Puget Sound streams are hatchery produced. From 1991 through 2000, approximately 24 million hatchery juvenile coho were released into Puget Sound each year. Over this period, total releases decreased from about 40 million in 1991 to less than 10 million in 2000 (Pacific States Marine Fisheries Commission 2002).[4]

Coho salmon occur in both Judd and Fisher creeks, however there is no information regarding the overall abundance of coho in the Vashon-Maury Island area. Hatchery and wild coho smolts feed along the shorelines of Vashon and Maury Islands between May and September of each year with most activity in May and June. Juvenile coho captured within the Maury Island site were found to be from wild stocks, Wallace River Hatchery (WRIA 7), Soos Creek Hatchery (WRIA 9), or Voights Creek Hatchery (WRIA 10). Juvenile coho caught along marine shorelines in King County appear to feed mainly on zooplankton before switching to fish at larger sizes (Brennan and Higgins 2004).

Coastal Cutthroat Trout (Oncorhynchus clarki clarki): Coastal cutthroat trout exhibit all four salmonid life histories – adfluvial, fluvial, resident, and anadromous (Wydoski and Whitney 2003). Different individuals from the same population can exhibit different life history patterns. Cutthroat trout are capable of repeat spawning and some individuals have been noted to spawn each year for as many as six years.

Anadromous, or sea-run, coastal cutthroat from smaller systems such as the streams on Vashon-Maury Island generally return to freshwater from December through March and spawn from February through late April. Cutthroat fry emerge from March through June, with a peak in mid-April. Anadromous forms of cutthroat rear in freshwater for one to six years before migrating to sea. Outmigration occurs from March through June, with a peak in mid-May.

Cutthroats are known to rear extensively in estuarine and nearshore habitats and many do not venture far from their natal streams. In general, sea-run cutthroat do not make long ocean migrations and they rarely overwinter at sea, instead they return to nearby streams to spend the winter.

Nonmigratory coastal cutthroat include fish generally found in small streams and headwater tributaries near spawning and rearing sites. They typically grow more slowly than the other life history forms of cutthroat, are smaller when they reach maturity, and normally do not live longer than two to three years.

[4] Data may be incomplete for 2000. Releases in 1999 were about 12 million.

Several streams on Vashon and Maury Islands have been documented to support cutthroat trout including Judd, Fisher, Shawnee, Tahlequah, and Mileta creeks (King County 2000). An impassible barrier in the form of a culvert currently precludes anadromous forms of cutthroat from inhabiting Shawnee Creek. Both resident and sea-run cutthroat are thought to inhabit Mileta, Judd, and Fisher creeks (EVS 2000). Cutthroat trout of all age classes are thought to use Quartermaster Harbor as a rearing area.

Puget Sound Steelhead (Oncorhynchus mykiss): Like cutthroat, rainbow trout exhibit great diversity in their life history patterns and are capable of repeated spawning across years, although most individuals are not repeat spawners. The anadromous form of rainbow trout, referred to as steelhead, can be divided into summer (stream-type) or winter (ocean-type) stocks. In Puget Sound the majority of steelhead populations are winter-run, meaning adults normally return to freshwater from November to December, and the peak of spawning occurs between March and May of the following year (Busby et al. 1997).

Steelhead eggs incubate for approximately four to seven weeks, with fry emerging from June through mid-August. After hatching, steelhead typically spend from two to four years in their natal stream before migrating to sea, with smolts outmigrating from April to June. Steelhead trout are thought to move more directly out to sea than other salmonids, although some steelhead rear for short periods in estuarine environments. They spend up to three years in the ocean before returning to spawn and typically live from six to eight years (Wydoski and Whitney 2003).

Total runs for Puget Sound steelhead in the early 1980s were estimated by Light (1987) as approximately 100,000 winter steelhead and 20,000 summer steelhead. Light provided no estimate of hatchery proportions for specific streams, but for Puget Sound and coastal Washington combined, he estimated that 70 percent of steelhead in ocean runs were of hatchery origin.

The only stream in the Maury Island area known to support steelhead is Judd Creek, but it is not known if the population is self sustaining or whether they are strays from other Puget Sound systems (Kerwin and Nelson 2000). There is no data pertaining to the abundance of steelhead in Judd Creek.

Bull Trout (Salvelinus confluentus): Puget Sound and Washington coastal bull trout populations were listed as threatened in November 1999 by the U.S. Fish and Wildlife Service (USFWS). Critical habitat for Puget Sound bull trout populations has yet to be designated.

Bull trout are a char species endemic to western North America that exhibits all four salmonid life history forms – resident, fluvial, adfluvial, and anadromous. They require colder water than most other Washington salmonids (2° to 10° Celsius), are heavily dependent on instream cover, and prefer low gradient stream reaches with clean, gravel substrates (Goetz 1989; WDFW 1998). These specific habitat

requirements are normally found in more pristine environments, thus bull trout are quite vulnerable to habitat modifications.

The 1998 bull trout/Dolly Varden population inventory, conducted by WDFW, identified 80 distinct stocks in Washington State. Bull trout are genetically distinct from Dolly Varden, although the species are managed together as they are difficult to differentiate without genetic analyses. All bull trout/Dolly Varden populations in Washington are maintained by wild production. Of the populations identified, 18 percent are considered healthy, three percent depressed, eight percent critical, and the status of the remaining 58 stocks is unknown (WDFW 1998).

There are no bull trout found in the streams of Vashon or Maury islands, and Quartermaster Harbor is generally too warm to be utilized by rearing, anadromous bull trout. Migrating anadromous bull trout could periodically inhabit the eastern shoreline of Maury Island, although no observations of the species in this area have been documented.

Forage Fish: The Maury Island site supports an abundance of forage fish stocks including Pacific herring, surf smelt, and sand lance.

Pacific Herring (Clupea harengus): Pacific herring is a pelagic (lives in open sea) marine species that depends heavily upon the nearshore environment for spawning. Herring spawning grounds are well defined and stocks of the fish show strong fidelity to particular spawning areas. Herring spawning timing is also very specific, seldom varying more than seven days from year to year (WDFW 2000). Most Puget Sound herring spawn from mid-January through March. Herring utilize a variety of marine vegetation in the intertidal and shallow subtidal zones for spawning, primarily in semi-exposed and semi-protected areas. The substantial eelgrass beds and semi-protected environment of Quartermaster Harbor makes for an ideal spawning location (Appendix G). The Quartermaster Harbor herring stock is one of 18 in the Puget Sound. This stock is the largest spawning population in the southern/central Puget Sound and among the largest in the entire Puget Sound region. Surveys conducted from 1994 through 2003 found an average biomass of the Quartermaster harbor herring stock of 1,123 short tons (Table 6).

Table 6. Pacific herring biomass in Quartermaster Harbor 1994-2003

Year	Herring Biomass (short tons)		Herring Biomass (short tons)
1994	1,412	1999	1,257
1995	2,001	2000	743
1996	805	2001	1,320
1997	1,402	2002	416
1998	947	2003	930
Average from 1994-2003			**1,123**

Source: WDFW 2004

Herring spawning usually occurs on aquatic vegetation from 0 to minus 10 feet (0 to 3 meters) in tidal elevation. The documented herring spawning area for the Quartermaster Harbor stock includes more than 962 acres of habitat (WDFW, unpublished data). While spawning has been documented in vegetated areas throughout Quartermaster Harbor and along the eastern shore of Maury Island, spawning activity is variable and typically concentrated within this larger area. The eggs incubate for 10 to 14 days prior to hatching. Following hatching, the larvae drift in the currents. When they are approximately 25 to 40 mm in length, juvenile herring begin to form schools and remain in the nearshore environment until they migrate to the open ocean in early fall, although some herring spend their entire lives in the Puget Sound (McCrae 1994; WDFW 2000). Highly productive areas such as eelgrass beds are important habitats for herring of all age classes, which is another reason herring are rather abundant in Quartermaster Harbor. After reaching sexual maturity at age two to four, herring return to their natal spawning grounds. At maturity, herring can reach a maximum size of about 18 inches.

In addition to herring spawning sites along the shoreline of Quartermaster Harbor and the southeast shoreline of Maury Island, there are also two pre-spawning holding locations near Neill and Piner Points (Appendix G). Herring congregate in these deeper water areas prior to migrating to nearshore habitat to spawn.

Surf Smelt (Hypomesus pretiosus): Surf smelt are a pelagic species, although many individuals remain in nearshore environments throughout the year. They feed on a variety of zooplankton and epibenthic organisms, including planktonic crustaceans and fish larvae. Spawning occurs during much of the year on mixed sand-gravel beaches at a tidal elevation between approximately plus 6.5 feet and the mean higher-high water line, or higher (Lemberg et al. 1997). Adults school offshore and may return to the same spawning ground each year. Surf smelt are relatively short-lived, with most spawning populations comprised of one and two-year old fish (Lemberg et al. 1997). Due to the species dependence on relatively undisturbed sandy beaches, surf smelt populations are vulnerable to shoreline modifications that may reduce or eliminate spawning habitat.

Surf smelt spawning locations have been documented in a number of places within Quartermaster Harbor (Appendix G). In addition, spawning activity has been noted along the southeastern shoreline and near Point Robinson. These documented spawning beaches represent 5.71 miles of shoreline habitat (WDFW, Unpublished Data). These fish are important food sources for salmonids, birds, and other wildlife in the area.

Sand Lance (Ammodytes hexapterus): Little is known about the life history of sand lance in Puget Sound. These fish spawn in the upper intertidal zone of sand-gravel or sand beaches, normally higher than plus 5 feet in tidal elevation. Spawning occurs from November through February. Eggs incubate for approximately 30 days and then sand lance larvae enter the nearshore environment. These fish are an important food source for salmonids, other marine aquatic species, and terrestrial wildlife.

There is only one documented area of sand lance spawning representing approximately 0.3 miles of shoreline habitat at the Maury Island site (Appendix G) and their abundance is unknown. Like surf smelt, sand lance are dependent upon sandy beaches and are therefore vulnerable to shoreline modification. The sand lance spawning area along the northeastern shore of Maury Island is one of the few sandy-beach areas in which the state has ownership of the intertidal zone.

Groundfish: Groundfish is a broad term used for fish that spend all or significant portions of their lives on or near the sea bottom (e.g., flatfish, rockfish). They are a diverse group that includes species such as spiny dogfish (*Squalus acanthias*), skates (*Raja sp.*), Pacific cod (*Gadus macrocephalus*), rockfish (*Sebastes sp.*), and lingcod (*Ophiodon elongates*). Of the more than two hundred species classified as groundfish in Puget Sound, only twenty-one are actively managed as commercial or recreational fisheries (Palsson et al. 1998).

While predator-prey interactions are not well understood, groundfish are an important prey item for marine mammals and piscivorous birds. Groundfish are carnivorous, preying upon benthic and epibenthic macroinvertebrates such as shrimp and crabs, as well as small fish, and likely compete with salmon and other fish stocks for habitat and food. Although groundfish populations within Puget Sound are not always well documented, it is known that they are vulnerable to reductions of kelp beds, habitat destruction from fishing gear, as well as decreased recruitment from the harvest of large and sexually mature individuals.

Flatfish: Most species of flatfish spawn during winter months on soft mud bottoms at depths of about minus 40 feet (12 meters) or greater. Fertilized eggs are pelagic and hatch within a few weeks, with the larvae slowly sinking as they mature. As juveniles, flatfish are physically similar to other round shaped fish, with a perpendicular orientation and a single eye on each side of their body. As the eye moves to a particular side, the fish swim oriented toward that side and eventually settle on the bottom in the nearshore. It is not until the fish reach adulthood, between two and four years of age, that they sever their relationship with the nearshore and move to deeper water. Flatfish can live as long as fifty years and reach sexual maturity at three to seven years of age.

In 2002, a WDFW bottom trawl of Quartermaster Harbor found a high diversity and concentration of flatfish including English sole (*Parophrys vetulus*), speckled sanddab (*Citharichthys stigmaeus*), Pacific sanddab (*Citharichthys sordidus*), and southern rock sole (*Lepidopsetta bilineata*).

Rockfish (Sebastes sp.): Sebastes bear live young and release them into the environment as larvae. Although males transfer sperm to females in the fall, actual fertilization can be delayed by as much as two to four months. Depending on species and size, each female releases between 200,000 and 800,000 larvae from January through May. Larvae are planktonic, floating near the surface and serving as a food

supply for plankton eating animals. After a few months, the juveniles begin to inhabit their preferred habitat of kelp forests and rocky reefs.

Fishing has taken a significant toll on rockfish numbers and reproductive success. Since the 1970s, recreational catches have declined by 50 to 60 percent (Puget Sound Water Quality Action Team 2002), with fishers targeting larger individuals. As *Sebastes* is a long-lived species (55 years or greater) and does not reach sexual maturity until 10 years of age or greater, the loss of larger fish may also be having a negative impact on recruitment. The Puget Sound Action Team (2002) estimates that rockfish spawning potential has declined 75 percent since the 1970s.

The eastern shore of Maury Island has several rocky reefs and submerged wrecks that are capable of supporting rockfish. Divers from WDFW have documented the presence of several species including lingcod *(Ophiodon elongatus)*, copper *(Sebastes caurinus)* and brown *(Sebastes auriculatus)* rockfishes, as well as red Irish lord *(Hemilepidotus hemilepidotus)* (W. Palsson, Research Scientists, Washington Department of Fish and Wildlife, personal communication, July 7, 2003).

Geoduck (*Panopea abrupta*): Geoduck clams are found from California to Alaska, although they are most abundant in the Puget Sound and coastal waters of British Columbia. Geoducks are found from the low intertidal zone to at least 360 feet (110 meters) in water depth and are most abundant in sand and silt substrates. The species is the largest of the burrowing clams, and grows rapidly with individuals in Puget Sound averaging 1.5 pounds within four or five years. They attain their maximum size and weight of approximately 2 pounds within 15 to 25 years (Hoffmann et al. 2000). Geoducks are very long-lived with some individuals reaching ages of over 160 years, with an average age at commercial tracts of about 46 years (Bradbury et al. 2000). Average density in the south and central areas of Puget Sound is approximately 0.18 geoducks/ft² (1.9 geoducks/m²) (Goodwin and Pease 1991).

There are six commercial geoduck tracts located at the Maury Island site. Harvest tract 10300 (62 acres) along the western shoreline of Quartermaster Harbor is currently unavailable for commercial harvest due to pollution concerns associated with failing septic systems in the vicinity (Sizemore and Ulrich 2002) (Appendix I).

The other five geoduck tracts include more than 433 acres and 6.6 million pounds of geoducks (Sizemore and Ulrich 2002). The state is not harvesting at these locations, nor is there any plan to do so in the immediate future. The Puyallup Tribe is harvesting at the Maury Island site along the eastern shoreline of Maury Island (harvest tract 10150) (Appendix I). Tract 10150 includes 130 acres along the entire eastern shoreline of Maury Island, with an estimated population of 1,371,000 geoducks weighing a total of about 3,702,000 pounds. Harvest in this area is restricted from January 1 through April 15 to areas deeper than minus 35 feet (10 meters) MLLW to protect herring spawning. There is also a recommended harvest boundary of minus 25 feet (7 meters) MLLW or deeper from April 16 through December 31 to protect herring habitat (WDFW 2003b). In 2002, Tribal harvest took approximately 142,086 pounds of geoducks from the southern portion of this tract.

In recent years, the Puyallup Tribe also conducted geoduck harvest within tract 10100, along the northern shoreline of Maury Island (Appendix I). This tract is comprised of 43 acres and is estimated to support approximately 124,000 geoducks with a total biomass of about 334,000 pounds. Tribal harvest through 2002 accounted for approximately 423,950 pounds of geoducks (WDFW 2003b). The Puyallup Tribe now believes that the tract has been depleted to the point that commercial harvest is not economically feasible and the tract is in recovery, although the post-harvest survey has not been completed. The time required for recovery of a commercial geoduck tract generally averages about 40 years in Puget Sound.

To protect eelgrass, WDFW mandates surveys prior to state harvest and a two-foot vertical buffer must be established around occurrences of rooted eelgrass. In areas with very shallow slopes, a 180-foot horizontal buffer (seaward and deeper than the deepest eelgrass) may be used instead of the vertical buffer (Bradbury et al. 2000).

Other Epifauna/Infauna: In addition to geoduck, species documented within the Maury Island site include: barnacles; mussels; nudibranch; hairy shore crab; heart cockle; chiton; cockle; Dungeness crab; flat worm; tube worm; red rock crab; sand dollar, sea anemone; sea star; sea urchin, and shrimp (Bloch et al. 2002). More than 80% of the infaunal bivalves in Quartermaster Harbor are suspension feeders and Manila clams (*Tapes philippinarum*), bent-nosed clams (*Macoma inquinata*), and macoma clams (*Macoma balthica*) were the most common species comprising 75%, 11% and 5% of observations (Landhal 1985). Compared to urban bays, samples from Quartermaster Harbor contain larger abundances or sizes of 'sensitive species' including sea cucumbers (*Cucumaria miniata*), spotted sea cucumber (*Cucumaria piperata*), crescent sea cumber (*Pentamera populifera*), edible sea cucumber (*Parastichopus californica*), sunstars (*Solaster stimpsoni*), hermit crabs (*Pagurus spp.*) and snails (*Nassarius mendicus*) (Gibson et al. 2000). A 2002 WDFW bottom trawl in Quartermaster Harbor revealed a high abundance of macroinvertebrates including Dungeness crab, red rock crab, red sea cucumber, and sea stars. In addition, there may be aquatic nuisance species present in the Maury Island site, as listed in Table 7 in the Aquatic Vegetation Section (Section 4.4.1.2).

4.4.1.2 Aquatic Vegetation

Native Vegetation Species: There is a variety of native aquatic vegetation at the Maury Island site that provides important habitat structure and function, with the most abundant being eelgrass and kelp.

The euphotic zone is the uppermost portion of the water column where light levels are high enough for photosynthesis to occur. Overall light transmission rates are affected by latitude, seasons, water quality, and suspended particulate matter (i.e., sediments and phytoplankton). In nutrient rich areas, the depth of the euphotic zone decreases as the incidence of algal blooms increases.

Within Puget Sound, nearshore ecosystem boundaries are generally defined by the depths at which aquatic vegetation can, or does, occur (Battelle 2003), although substrate and water current are also factors for vegetative growth. As a result, in some regional literature the outer limit of the nearshore and euphotic zones are defined similarly and placed at approximatly minus 66 feet (- 20 meters) below mean low low water (MLLW) (Williams et al. 2001).

A wide diversity of aquatic vegetation is found within and adjacent to the site. In the intertidal zone common species include pickleweed (*Salicornia virginica*), eelgrass (*Zostera marina* and *Zostera japonica*), sea lettuce (*Ulva lactuca*), rockweed (*focus gardneri*), and link confetti (*Enteromorpha intestina*). The subtidal areas are also vegetated with alga and eelgrass species. Common alga and kelps in the area include red algae (*Agardhiella tenera, Gracilariopsis sjoestedt, Callophyllis sp., Ceramium sp.*), Turkish towel (*Gigartina exasperate*), sugar wrack (*Laminaria sacchirina*), bull kelp (*Nerocystis luetkeana*), a Japanese weed (*Sargassum muticum*), and Whip tube (*Scytosiphon lomentaria*). An unknown quantity and diversity of phytoplankton also occur within the water column. The specific distribution of these species is governed by local habitat conditions including the sediment type (e.g., the presence of rock or sandy sediments), light transmittance, and current.

Eelgrass (Zostera marina): Eelgrass is a subtidal grass that spreads by rhizomes and prefers sandy/silt substrates. It can be found as individual plants, small patches, or large meadows in the low intertidal and shallow subtidal zones. Central Puget Sound eelgrass beds have been found at depths ranging from +5.25 feet (1.6 meters) to –24 feet (7.3 meters) relative to MLLW (Berry et. Al 2003). The primary factor controlling distribution at the upper boundary is desiccation stress, and at the lower boundary is light penetration (Thom et al. 1998). Like terrestrial grasses, eelgrass meadows are most dense in the spring and summer, going dormant, and decaying during the fall and winter. In addition to protecting shorelines from wave and current driven erosion, eelgrass roots help anchor sediments and keep shallow subtidal environments moist and cool during low tides. Eelgrass is a key element in Puget Sound food webs and supports a variety of organisms, including zooplankton, juvenile salmonids, small crabs (e.g., spider crab), nudibranch, larval forage fish (e.g., herring), and a variety of small fish such as pipefish and gunnels.

Shoreline surveys found continuous or patchy eelgrass beds offshore of 78 percent (18.65 of 23.88 miles) of the shoreline within the Maury Island site (Nearshore Habitat Program 2001). Eelgrass observations in Quartermaster Harbor suggest that while the abundance of eelgrass may have changed within or between beds, the distribution of eelgrass has changed little over the past thirty years (WDFW, unpublished data). There are significant eelgrass beds scattered throughout the Maury Islands site, both within Quartermaster Harbor and along the eastern shore of Maury Island, making it an important area for salmonids, forage fish, and a variety of piscivorous birds and mammals (Appendix F).

Kelp (sp.): Kelp is a common macroalgae that occurs in water depths of 50 to 100 feet (15 to 30 meters) at various locations within the Maury Island site. Unlike eelgrass, which actually roots in the sediments, kelp is held in place by structures called holdfasts that anchor the algae to rocky substrates (Nybakken 1997). Similar to eelgrass, kelp serves to decrease erosional impacts from waves and currents on nearshore environments. Growth rates for kelp can exceed 2.4 inches (6.0 centimeters) a day and at maturity, individual kelp may be 65 to 100 feet (20 to 30 meters) in length. Kelp is an important component of nearshore primary production rates (Nybakken 1997) and in Puget Sound it provides important habitat for a number of grazers (e.g., snails and sea urchins), filter feeders (e.g., anemones), scavengers (e.g., crabs), and predators (e.g., rockfish, starfish, and salmonids), as well as a variety of smaller algae. Bladder kelp forests are located in areas where the seafloor is covered by rocky outcrops and boulders near the mouth of Quartermaster Harbor, south of Rosehilla and northeast of Neill Point (Blau 1975). There is no evidence of continuous kelp beds within the Maury Island site, but patchy distributions have been reported along the western and eastern shorelines of the island (Appendix F).

Invasive Nuisance Species: There is also evidence of invasive nuisance species (i.e., *Spartina*) that occur in the area, although these species have not been fully inventoried.

Spartina (Spartina sp.): Spartina is a highly aggressive and invasive aquatic plant species that can degrade the quality of tideflats. *Spartina* grows on tideflats and traps sediment from the water column, causing increased elevation and vegetation changes. These physical alterations can reduce productivity and habitat suitability for many native plant and animal species (Williams et al. 2000).

Spartina was first discovered on Vashon Island in 1993 at Fern Cove on the northwest side of Vashon Island. Since then, *Spartina* has been found near the Maury Island site in Raab's Lagoon, Point Heyer, and Tramp Harbor. Populations found to date near the Maury Island site are small and have responded well to management (Eisenberg et al. 2001). In recent years, local organizations have surveyed the island by boat and reported findings to Washington Department of Agriculture for management.

While several other invasive species have been detected within or near the aquatic reserve, no systematic survey has attempted to assess which species are present. Table 7 describes non-native and species of unknown origin (cryptogenic) that have been detected in Puget Sound and several species on this list are likely to occur within the aquatic reserve. The information in this table on native regions, transport mechanisms and collections is based on Carlton 1979, Cohen and Carlton 1995, Cohen *et al.* 1998 and Mills *et al.* 2000 unless otherwise noted.

Table 7 Exotic and Cryptogenic Species in Puget Sound

Organism	Records
Phaeophyceae	
Sargassum muticum (Yendo, 1907) Fensholt, 1955	Native to Japan and introduced with oyster aquaculture. First recorded on Pacific Coast in 1944 and in Puget Sound in 1948; present throughout Puget Sound by the early 1960s (Scagel 1956; Thom and Hallum 1991).
Anthophyta	
Cotula coronopifolia Linnaeus, 1753	Native to South Africa and probably introduced in solid ballast. First recorded on the Pacific Coast at San Francisco in 1878 and now spread from southern California to British Columbia, including Puget Sound. Often occurs as an ephemeral colonizer in newly restored salt marshes (Frenkel 1991).
Spartina alterniflora Loiseleur-Deslongchamps	Native to the northwestern Atlantic and first reported on the Pacific Coast in Puget Sound, where it was planted in the 1930s for duck habitat. It probably arrived earlier in Willapa Bay, where it may have been introduced in solid ballast, as seeds accidentally transported with oysters imported for culturing, or possibly as packing material for ship-transported goods.
Spartina anglica C.E. Hubbard, 1968	A new species derived from accidental hybridization in southern England and northern France in the 1800s, Introduced to Puget Sound in Susan Bay for shoreline stabilization and cattle forage in 1961 (Frenkel 1987).
Spartina patens (Aiton)	Native to the northwestern Atlantic. Probably introduced as packing material for ship-transported goods, or possibly in solid ballast or as seeds accidentally transported with oysters imported for culturing.
Zostera japonica Ascherson and Graebner, 1907	Native to the western Pacific and introduced with oyster aquaculture. First recorded on the Pacific Coast in 1957 and in Puget Sound in 1974 (Harrison and Bigley 1982).
Foraminifera	
Trochammina hadai Uchio 1962	Native to Japan, and probably introduced either in ballast water, in hull fouling or with oyster aquaculture. First recorded on the Pacific Coast in Puget Sound in 1971 (McGann *et al.* 2000).
Cnidaria: Hydrozoa	
Cladonema radiatum Dujardin, 1843	Native to the Northwestern Atlantic. First collected on the Pacific Coast in Puget Sound in 1988 (Mills 1998).
Cordylophora caspia (Pallas, 1771)	Native to the Black and Caspian Seas. Either an early introduction with ballast water or possibly introduced in hull fouling. First recorded on the Pacific Coast in Puget Sound around 1920. Reported in some literature as *Cordylophora lacustris*.
Cnidaria: Anthozoa	
Diadumene lineata (Verrill, 1869)	Native to Asia. First recorded on the Pacific Coast in San Francisco Bay in 1906, and in Puget Sound in 1939. Either introduced in hull fouling from Asia, or with shipments of oysters from the Atlantic, where it had been introduced (probably in hull fouling) in the late 1880s. Reported in some earlier literature as *Haliplanella luciae*.

Platyhelminthes	
Pseudostylochus ostreophagus Hyman, 1955	An oyster pest native to Japan and introduced in oyster aquaculture. First recorded on the Pacific Coast in Puget Sound in 1953.
Annelida: Polychaeta	
Hobsonia florida (Hartman, 1951)	Native to the northwestern Atlantic, and first recorded on the Pacific Coast in Puget Sound in 1940.
Neanthes succinea (Frey and Leuckart, 1847)	Native to the Atlantic and introduced by oyster aquaculture to San Francisco Bay by 1896. First recorded in Puget Sound around 1995.
Pseudopolydora kempi (Southern, 1921)	Native to Japan and probably introduced with oyster aquaculture, or possibly in hull fouling or ballast water. First recorded on the Pacific Coast at Nanaimo on the east coast of Vancouver Island in 1951, and in Puget Sound on San Juan Island in 1968. Has generally been listed as exotic on the Pacific Coast (Carlton 1979; Cohen and Carlton 1995; T N and Associates 2002); but was reported as cryptogenic in the Columbia River (Draheim et al. 2003).
Pseudopolydora paucibranchiata (Okuda, 1937)	Native to Japan and introduced with oysters, in hull fouling or in ballast water. First recorded on the Pacific Coast in southern California in 1950, and in Puget Sound in 1993.
Mollusca: Gastropoda	
Batillaria attramentaria (Sowerby, 1855)	A Japanese oyster pest introduced with oyster aquaculture. First recorded on the Pacific Coast in Puget Sound in 1924, or possibly 19i8-19. Reported in some Pacific Coast literature as *B. zonalis* or *B. cumingi.*
Crepidula fornicata Linnaeus, 1758	An oyster pest native to the northwestern Atlantic and introduced with oyster aquaculture. First recorded on the Pacific Coast in Puget Sound in 1905.
Crepidula plana Say,1822	Native to the northwestern Atlantic and introduced with oyster aquaculture. First recorded on the Pacific Coast in San Francisco Bay in 1901, and in Puget Sound in 1949.
Myosotella myosotis (Draparnaud, 1801)	Occurs on both coasts of the North Atlantic, but may be native only to Europe. First reported on the Pacific Coast in San Francisco Bay in 1871, where it was probably introduced with oyster aquaculture, although possibly carried in solid ballast or hull fouling. The first record in Puget Sound is from 1936, or possibly a 1927 specimen labeled "Juan de Fuca." It has since been reported from many locations in the Sound.
Nassarius fraterculus (Dunker, 1860)	Native to Japan and introduced with oyster aquaculture. First collected on the Pacific Coast in Puget Sound, in Padilla Bay in 1960 and Samish Bay in 1963 (Carlton 1979: 412).
Ocinebrellus inornatus (Recluz, 1851)	An oyster pest native to Japan and introduced with oyster aquaculture. First recorded on the Pacific Coast in Puget Sound in 1924. Reported in some literature as *Ocenebra japonica* or *Ceratostoma inornatum*.
Urosalpinx cinerea (Say, 1822)	An oyster pest native to the northwestern Atlantic and introduced with oyster aquaculture. First recorded on the Pacific Coast in San Francisco Bay in 1890-91 and in Puget Sound in 1929.

Mollusca: Bivalvia	
Crassostrea gigas (Thunberg, 1793)	Native to Japan and introduced for aquaculture. First planted on the Pacific Coast in Puget Sound in 1875. It is cultured extensively in South Puget Sound and reproduces successfully in Dabob Bay (Emmett *et al.* 1991).
Musculista senhousia (Benson, 1842)	Native to Asia and introduced with oyster aquaculture. First recorded on the Pacific Coast in Samish Bay on planted Japanese oysters, and found in the wild in central California in 1941 and in Puget Sound at Olympia in 1959. Reported in some literature as *Musculus senhousia*.
Mya arenaria Linnaeus, 1758	Native to the northwestern Atlantic and introduced with oyster aquaculture. First recorded on the Pacific Coast in 1874, and in Puget Sound in 1888-89, where it is widely established (Emmett *et al.* 1991).
Nuttallia obscurata (Reeve, 1857)	Native to the northwestern Pacific and probably introduced in ballast water. First recorded on the Pacific Coast in 1991 and in Puget Sound in 1993 (Forsyth 1993).
Venerupis philippinarum (Adams and Reeve, 1850)	Native to the northwestern Pacific, accidentally introduced with oyster aquaculture. First recorded on the Pacific Coast in Puget Sound in 1924, where it is both widely cultivated and established in the wild (Emmett *et al.* 1991). Reported in some earlier literature as *Ruditapes philippinarum*, *Tapes japonica* or *Venerupis japonica.*
Arthropoda: Crustacea: Copepoda	
Mytilicola orientalis Mori, 1935	Native to Asia and introduced in oyster aquaculture. First recorded on the Pacific Coast in Willapa Bay in 1938, and in Puget Sound in 1943.
Arthropoda: Crustacea: Cumacea	
Nippoleucon hinumensis (Gamo, 1967)	Native to Japan and introduced in ballast water. First recorded on the Pacific Coast in 1979, and in Puget Sound in the mid-1990s. Reported in some earlier literature as *Hemileucon hinumensis*.
Arthropoda: Crustacea: Tanaidacea	
Sinelobus stanfordi (Richardson, 1905)	Origin unknown. Possibly introduced in ship fouling or ballast water. First recorded on the Pacific Coast in 1943, and in Puget Sound since the mid-1990s.
Arthropoda: Crustacea: Isopoda	
Caecidotea racovitzai (Williams, 1970)	Native to the northwestern Atlantic and possibly introduced in ballast water or with aquarium or ornamental pond plants. Primarily occurs in fresh water, but has been collected in brackish water including the Snohomish River Estuary in 1997 (Toft *et al.* 2002).
Limnoria tripunctata Menzies, 1951	Origin unknown. Introduced in hull fouling. First recorded on the Pacific Coast in California in the 1870s and in Puget Sound in 1962.

Arthropoda: Crustacea: Amphipoda	
Ampithoe valida Smith, 1873	Native to the northwestern Atlantic, and introduced by ballast water, oyster aquaculture or hull fouling. First recorded on the Pacific Coast in 1941, and in Puget Sound in 1966.
Caprella mutica Schurin, 1935	Native to the Sea of Japan and introduced by ballast water or oyster aquaculture. First recorded on the Pacific Coast in 1973-77, and in Puget Sound in 1998. Reported in some literature as *Caprella acanthogaster*.
Eochelidium sp.	Probably native to Japan or Korea, and introduced in ballast water. First recorded on the Pacific Coast around 1993, and in Puget Sound in 1997.
Grandidierella japonica Stephensen, 1938	Native to Japan, and introduced by ballast water, oyster aquaculture or hull fouling. First recorded on the Pacific Coast in 1966, and in Puget Sound in 1977.
Jassa marmorata Holmes, 1903	Native to the northwestern Atlantic and introduced in ballast water or hull fouling. First recorded on the Pacific Coast in 1938, and in Puget Sound around 1995.
Melita nitida Smith, 1873	Native to the northwestern Atlantic, and introduced by ballast water, oyster aquaculture, solid ballast or hull fouling. First recorded on the Pacific Coast in 1938.
Monocorophium acherusicum Costa, 1857	Native to the northern Atlantic, and introduced by oyster aquaculture or hull fouling. First recorded on the Pacific Coast in 1905, and in Puget Sound in 1974-75. Reported in the literature as *Corophium acherusicum* until recently.
Monocorophium insidiosum Crawford, 1937	Native to the northern Atlantic, and introduced by oyster aquaculture or hull fouling. First recorded on the Pacific Coast in 1915 and in Puget Sound in 1949. Reported in the literature as *Corophium insidiosum* until recently.
Parapleustes derzhavini (Gurjanova, 1938)	Native to the western Pacific and introduced in hull fouling. First recorded on the Pacific Coast in 1904, and in Puget Sound in 1998.
Kamptozoa	
Barentsia benedeni (Foettinger, 1887)	Native to Europe, and introduced by oyster aquaculture or hull fouling. First recorded on the Pacific Coast in 1929, and in Puget Sound in 1998.
Bryozoa	
Bowerbankia gracilis Leidy, 1855	Probably native to the western Atlantic, and introduced by oyster aquaculture or hull fouling. First recorded on the Pacific Coast by 1923, and in Puget Sound by 1953.
Bugula sp. A	First recorded on the Pacific Coast in Puget Sound in 1993.
Bugula sp. B	First recorded on the Pacific Coast in Puget Sound in 1998.
Bugula stolonifera Ryland, 1960	Native to the northwestern Atlantic and introduced in hull fouling. First recorded on the Pacific Coast by 1978, and in Puget Sound in 1998.
Cryptosula pallasiana (Moll, 1803)	Native to the northern Atlantic, and introduced with oyster aquaculture or in hull fouling. First recorded on the Pacific Coast in 1943-44 and, in Puget Sound in 1998.
Schizoporella unicornis (Johnston, 1847)	Native to the northwestern Pacific, and introduced by oyster aquaculture or hull fouling. First recorded on the Pacific Coast in Puget Sound in 1927.

Urochordata: Tunicata	
Botrylloides violaceus Oka, 1927	Native to Japan, and introduced by oyster aquaculture or hull fouling. First recorded on the Pacific Coast in 1973, and in Puget Sound in 1977.
Botryllus schlosseri (Pallas, 1766)	Native to the northeastern Atlantic, and introduced by oyster aquaculture or hull fouling. First recorded on the Pacific Coast in 1944-47, and in Puget Sound in the 1970s.
Ciona savignyi Herdman, 1882	Native to Japan, and introduced in ballast water or hull fouling. First recorded on the Pacific Coast in 1985, and in Puget Sound in 1998.
Molgula manhattensis (DeKay, 1843)	Native to the northwestern Atlantic, and introduced by ballast water, oyster aquaculture or hull fouling. First recorded on the Pacific Coast in 1949, and in Puget Sound in 1998.
Styela clava Herdman, 1881	Native to the region from China to the Sea of Okhotsk, and introduced by ballast water, oyster aquaculture or hull fouling. First recorded on the Pacific Coast in 1932-33, and in Puget Sound in 1998.
Chordata: Pisces	
Alosa sapidissima (Wilson, 1811)	Native to the northwestern Atlantic, and intentionally introduced to the San Francisco Bay watershed in 1871. Collected in the Columbia River in 1876 (Smith 1896), and fry were stocked there in 1906 (Draheim 2002: 11). Adults and juveniles are common in Skagit Bay, and rare in other parts of Puget Sound (Emmett *et al.* 1991).

4.4.1.3 Marine Mammals

River Otter (Lontra anadensis): River otters are fairly common throughout Puget Sound and are likely to occur within the Maury Island site. Although river otters hunt and den on land, they also rely heavily on a diet of fish and shellfish and can be expected to feed in the shallow inter- and sub-tidal areas throughout the Vashon and Maury Island areas, as well as at small estuaries such as the mouth of Judd Creek. They require deep and fairly clean water to remain healthy, and their position near the top of the aquatic food web makes them extremely susceptible to bioaccumulation of contaminants such as mercury, PCBs, Dichloro Diphenyl Trichloroethane (DDT), dieldrin, and other pesticides.

Females reach sexual maturity at about two years of age, while males are mature at about five years. Breeding occurs in late winter to early spring, and litters of between one and four are born within nine to twelve months. Pups are weaned within four months, but spend several months with their mothers learning to hunt. Otters can live as long as 13 years in the wild and have few natural predators that would occur within the Maury Island site.

Harbor Seals (Phoca vitulina): Harbor seals are rather common throughout the central Puget Sound area and may be present, periodically, at the Maury Island site. They reach about four to six feet in length and weigh between 176 and 300 pounds. They tend to favor nearshore coastal waters and are often seen at sandy beaches, mudflats, bays, and estuaries. They spend about half their time on land and half in water, and they sometimes sleep in water. They are opportunistic feeders, eating herring, sole, sculpin, flounder, salmonids, and other available fish (Marine Mammal

Center 2000). There are no harbor seal haul-out sites in the vicinity of the Maury Island site and abundance of the species in the area is not known.

California Sea Lion (Zalophus californianus): California sea lions are occasionally observed resting on buoy markers "TC" off southeastern Maury Island and "TB" off Point Robinson. They are extremely social creatures and hunt throughout the day and night, feeding on salmon, octopus, and other pelagic fish. Their sizes vary with gender and age. Females weigh about 200 pounds at maturity, whereas males weigh about 600 pounds or greater.

Killer Whale (Orcinus orca): The Puget Sound Orca population is listed as endangered by WDFW and a review of its listing under the federal Endangered Species Act was ordered in late fall of 2003. Killer whales frequent a variety of marine habitats with adequate prey resources and do not appear to be constrained by water depth, temperature, or salinity (Baird 2000). During early autumn, southern resident pods expand their routine movements to include Puget Sound in addition to Georgia Strait, San Juan Islands, and Strait of Juan de Fuca. During this annual range expansion Orca are regularly observed in the vicinity of the Maury Island site and may occasionally feed along the outer shoreline of Vashon and Maury Islands, and less frequently, may enter Quartermaster Harbor. This expansion of range is believed to be in response to chum and Chinook salmon runs (Osborne 1999). Similar to otter and sea lions, Orca are top predators and extremely susceptible to bioaccumulation of toxins in the food web.

4.4.1.4 Terrestrial Wildlife (Birds)

Primary Bird Species: The Maury Island area offers wetland and riparian habitat for several species of migratory and resident marine birds. WDFW winter surveys between 1993 and 2002 identify American widgeon, surf and white-winged scoters, common and barrow's goldeneye, bufflehead, gulls and western grebes as the most common wintering marine birds (WDFW, unpublished data). Average and peak observations for common bird species are shown in Table 8. Common resident birds include glaucous-winged gulls, black brant and the great blue heron (NORTEC 1984). Aside from specific areas with substantial human development (i.e., Gold Beach, Sandy Shores, Dockton, and Burton), the areas adjacent to the Maury Island site has riparian habitat that is largely intact and supports a number of bird populations, both seasonal and resident. In addition to being sheltered and relatively undisturbed by boat traffic, the site offers a plentiful food supply for aquatic piscivorous birds in the form of forage fish, juvenile salmonids, and shellfish.

Table 8: Average and peak observations for wintering marine birds within the Maury Island site (WDFW, unpublished data)

Species	Average annual count (1992 – 2001)	Peak 1-day Count	Date of Peak Count
American Widgeon	152.1	403	12/08/1999
Bufflehead	103.8	144	12/11/2000
Barrow's Goldeneye	36.9	116	12/10/2001
Common Goldeneye	41.3	99	12/11/1992
Unidentified Goldeneye Sp.	144.6	314	12/28/1995
Surf Scoter	267	698	12/11/1992
White-winged Scoter	119.1	294	12/11/1992
Unidentified Scoter Sp.	715.2	1218	12/28/1995
Western Grebe	602.6	1664	12/18/1996
Gull (all species)	252.4	409	¼/1995

Quartermaster Harbor has been designated an important bird area (IBA) by the Audubon Society of Washington and supports approximately 8 percent of Washington's wintering population of Western grebe (Cullinan 2001). In addition to grebe, the area provides winter refuge for approximately 3,000 individuals from 35 species of aquatic birds annually (Cullinan 2001). The IBA program has two primary goals: 1) to identify the sites in the state of Washington that are the most essential for long-term conservation of birds, and 2) to take action to ensure the conservation of these sites.

Western Grebe (Aechmophorus occidentalis): The western grebe is considered by WDFW to be a candidate species for inclusion on the state species of concern list (Table 9). Grebes prefer to winter in sheltered, ice-free waters with large supplies of forage fish, which makes Quartermaster Harbor ideal habitat. Although almost 100% of the bird's diet is fish, they also eat crustaceans, worms, and insects, spearing their prey with their long, pointed bills. Adult birds range from 22 to 30 inches in length and have long necks, with their feet positioned at the far back of the body, making walking difficult (Pease 2000). The birds migrate north beginning in late April and return to the site during September and October (Kirschenbaum 1996).

The presence of a relatively large population of wintering western grebe in Quartermaster Harbor was the primary reason that Audubon Washington listed the area as an IBA. From 1989 through 1991, surveys found an average winter abundance of 1,435 grebes in the area. Additional surveys conducted from 1999 through 2002 observed an average total of 2,345 individuals in the area during winter months (Willsie 2003). Annual winter flyover surveys from 1992 to 2001 detected an average of 603 grebes per survey year with a peak one-day count of 1664 western grebes in 1996 (WDFW, unpublished data). These surveys illustrate that Quartermaster Harbor area is regularly used by large numbers of wintering western grebes.

Great Blue Heron (Ardea herodias): The great blue heron is a rather large bird attaining lengths of between 42 and 52 inches. They have long and slender bills, necks, and legs and they fly with a distinctively folded back neck. The great blue heron feeds in shallow waters, standing along the margin and using their long bills like tongs to clamp their prey. They tend to congregate near areas with eelgrass to take advantage of the abundance of forage fish (Quinn and Milner 1999). They are communal nesters that utilize rather tall trees, normally at least 30 feet in height, adjacent to feeding areas. Due to their dependence on nesting trees, the species is sensitive to riparian vegetation clearing, particularly near eelgrass beds.

The Mileta Creek Wildlife Refuge recently supported one of the largest Great Blue Heron rookeries in King County, located on the eastern shore of Quartermaster Harbor. Recent anecdotal reports suggest that this rookery may have been abandoned.

While currently not included on the state list of species of concern, WDFW has noted an apparent decline in the species and is monitoring populations. Although there are little data pertaining to the abundance of great blue herons in this area, surveys conducted in Quartermaster Harbor from 1999 through 2001 noted an average of six individuals (Willsie 2003).

Bald Eagle (Haliaeetus leucocephalus): Bald eagles were first protected by the Bald Eagle Protection Act of 1940 and later listed as endangered under ESA. In 1978, the bald eagle was reclassified as threatened in five states, including Washington. Bald eagle are also listed as a threatened species on the Washington State species of concern list (Table 9). In the past 20 years, the population of nesting bald eagles has grown about 10 percent per year as eagles reoccupy habitat (Stinson et al. 2001). Recovery is especially dramatic in Washington State, where there are now over 600 nesting pairs, with approximately 300 pairs in Puget Sound alone. Due to the demonstrated recovery of the species, in 1999 the USFWS proposed to remove bald eagles from the list of threatened and endangered species (64 FR 36454). To date, no decision has been made regarding the proposed delisting.

Bald eagles are found wherever food (i.e., fish and waterfowl) is abundant, with nesting typically occurring in forested settings that are relatively free from human disturbance (Stalmaster 1987). Nesting pairs return to the same nesting territories year after year, while wintering groups tend to be more transitory. In Puget Sound, the seasonal home range containing the foraging and nesting habitat of an eagle pair averages about 2.6 square miles (Stinson et al. 2001). Territories usually include large bodies of water, as the species tends to prefer fish to all other types of prey, although they may also feed on small mammals and waterfowl (Stalmaster 1987). Bald eagles are opportunistic feeders and forage most intensively at first daylight and at low tide (Watson et al. 1991). In the Puget Sound, nest initiation begins sometime in February and the breeding cycle ends when the juveniles disperse near the end of August (Stalmaster 1987).

There is one bald eagle nesting area near the Maury Island site and more than 10 additional nests in the local vicinity. The one nest closest to the reserve boundary is near Neill Point. Bald eagle feeding areas extend along the southern shore of Vashon Island into Quartermaster Harbor and along the southern shoreline of Maury Island (Appendix H). There is little information regarding the abundance of bald eagles using the Maury Island site, although surveys conducted from 1999 through 2001 noted an average of four individuals.

Marbled Murrelet (Brachyramphus marmoratus): Marbled murrelets in Washington, Oregon, and California were listed as a threatened species under the federal Endangered Species Act in 1992 and are also listed as a threatened species on the Washington State species of concern list (Table 9). Classified as diving seabirds, murrelets are small (0.5 pounds) birds. The species primarily feed on small fish such as sand lance, smelt, and herring, which makes Quartermaster Harbor a suitable location for these birds. They are normally found in small groups of two to twelve, although they may form larger groups in abundant feeding areas. They spend the majority of their lives within approximately one mile of the coastline, although they nest up to about 45 miles inland in old growth trees.

There have been reported, although unconfirmed, sightings of marbled murrelets in the vicinity of Point Robinson. There is no information regarding abundance or frequency of use of the species in this area and the Maury Island site is not within the species' designated critical habitat.

Other Bird Species: In addition to the species described above, there are a number of other species of grebes, cormorants, ducks, swans, geese, gulls, and loons in the area, some of which are included on the Washington State species of concern list (Table 9). Waterfowl such as mallard, scoters, goldeneye, and bufflehead tend to be the most common bird species in the area.

Table 9 . Bird species of concern present at the Maury Island site.

Common Name	Scientific Name	Federal Listing Status	State Listing Status
Western grebe	*Aechmophorus occidentalis*	None	Candidate
Bald eagle	*Haliaeetus leucocephalus*	Threatened	Threatened
Marbled murrelet	*Brachyramphus marmoratus*	Threatened	Threatened
Harlequin duck	*Histrionicus histrionicus*	Species of Concern	None
Common loon	*Gavia immer*	None	Sensitive
Brandt's cormorant	*Phalacrocorax penicillatus*	None	Candidate
Common murre	*Uria aalge*	None	Candidate
Red-necked grebe	*Podiceps grisegena*	None	Monitor
Horned grebe	*Podiceps auritus*	None	Monitor
Source: Willsie 2003; WDFW 2003c			

4.4.2 Impact Analysis

4.4.2.1 Alternative 1 (Preferred Alternative)

The Preferred Alternative would have a moderate probability of causing positive direct impacts to plant and animal species and communities at discrete locations throughout the site and positive indirect impacts to plant and animal species and communities in and around the site.

Implementing the Preferred Alternative has the potential to greatly benefit the plant and animal communities that are located within, and/or that are dependent upon the Maury Island site. However, to be successful, management of the Maury Island site needs to recognize the interconnections between terrestrial and aquatic environments both within and outside of the Maury Island site, as well as those between activities on public and privately owned lands. Since DNR's direct authority is limited to uses of state-owned aquatic lands, positive impacts to both plants and animals would be greatly enhanced through voluntary cooperation with other natural resource agencies (WDFW, Ecology, and King County Department of Natural Resources), local planning entities, adjacent landowners, and recreational user groups.

Salmonids*:* Implementation of the Preferred Alternative would have little direct impact on salmonid spawning in Judd Creek (for Chinook, chum, coho, steelhead, and cutthroat), Fisher Creek (for cutthroat) or Mileta Creek (for cutthroat). However, possible joint efforts with King County and/or the Department of Ecology to improve the quality of freshwater inputs to the Maury Island site may have direct, positive impacts. Increases in streamside riparian vegetation would reduce water temperatures, as well as improve dissolved oxygen concentrations, decrease erosion and siltation of spawning beds, decrease nutrient inputs, and provide increased food supplied of terrestrial insects for resident fish and rearing juveniles. Similarly, outreach and

education efforts regarding stream management and stormwater would also have the potential to decrease harmful inputs to streams and ultimately Quartermaster Harbor.

The Preferred Alternative would have a direct and positive impact on rearing habit and migration corridors throughout the site. Through the use of best management practices and operational and constructions standards for marinas, over-water structures, recreational docks, and mooring buoys, critical nearshore aquatic vegetation would be protected. By ensuring the protection of eelgrass and kelp, the proposed reserve would also protect their associated fauna, thereby ensuring both shelter and food for the salmonids that utilize the area (Chinook, coho, chum, coastal cutthroat, and steelhead). Educational efforts aimed at decreasing the use of hard shoreline armoring and improving terrestrial vegetative cover would also lead to improved nearshore habitat by providing suitable substrate for aquatic vegetation, as well as cooler intertidal waters and increased supplies of terrestrial insects for rearing juveniles. The erosive effects of offshore winds and currents on benthic environments would also decrease as eelgrass and kelp beds increased.

Forage Fish: Similar to salmonids, exercising the Preferred Alternative offers a variety of benefits for forage fish populations (Pacific herring, surf smelt, and sand lance) within the Maury Island site. The risk of disease transfer from impounded herring to wild herring is decreased by preventing herring pens from being located within the herring spawning areas when spawning herring and larvae are likely to be present. Protection of eelgrass beds would positively impact herring spawning success, while also ensuring food and shelter for other forage fish populations. Partnerships with King County to encourage and fund the voluntary use of soft shoreline armoring techniques would also help to ensure sand and gravel substrates for surf smelt and sand lance spawning. Utilizing soft armoring techniques would benefit forage fish habitat by providing suitable substrate for aquatic vegetation and decreasing wave action on intertidal benthic environments. Educational efforts aimed at decreasing nutrient inputs from malfunctioning septic systems and residential landscaping techniques, would also protect nearshore habitat for forage fish by limiting phytoplankton development and associated decreases in water clarity. In addition, while DNR has little control over the management of the herring fishery, the proposed reserve may also lead to the protection of the two herring holding areas off Neill and Piner Points, as portions of these holding areas would be within the proposed reserve boundary.

Groundfish: Groundfish are dependent on kelp beds and rocky nearshore environments throughout their lives. While DNR does not regulate groundfish fishing, educational efforts aimed at decreasing nutrient inputs from malfunctioning septic systems and residential landscaping techniques would lead to decreases in algal blooms and an increase in water clarity, benefiting kelp beds. In addition, limits on the construction and operation of structures within the Maury Island site would prevent the destruction of rocky habitats. Both impacts would protect juveniles as well as reproductive adults and should lead to increases in rockfish survival within the Maury Island site. However, groundfish tend to be attracted to any submerged

structures and are common around several docks and derelict structures within the Maury Island site. If derelict pilings and submerged structures are removed or prevented from being built, current and potential future habitat for groundfish would be reduced at the Maury Island site. This reduction would return groundfish habitat to natural, historic levels. These actions could reduce groundfish numbers in discreet areas of the Maury Island site.

Epifauna/Infauna: Macroinvertebrates such as geoduck and crab, as well as sea stars, worms, anemones and urchins are all dependent on nearshore environments. By implementing the Preferred Alternative DNR would be able to protect the substrate and vegetative communities that epifauna and infauna depend on through the use of best management practices and operational and construction standards for marinas, over-water structures, recreational docks, and mooring buoys. Partnerships with King County and Ecology would also benefit these species by improving water quality, thereby minimizing threats to water clarity and the euphotic zone, as well as minimizing erosion and shoreline hardening. As many of these species are key in the Puget Sound food web, their protection also directly benefits fish populations as well as marine mammals and birds.

Aquatic Vegetation: The Preferred Alternative would positively impact eelgrass and kelp beds through the implementation of the best management practices and operational and construction standards for marinas, over-water structures, recreational docks, and mooring buoys. Partnerships with King County and the Department of Ecology would also benefit these species by improving water quality, minimizing threats to water clarity and the euphotic zone, as well as minimizing erosion and shoreline hardening. Protection of eelgrass and kelp beds would have a cascading effect on species dependent on nearshore vegetation by improving amounts and quality of shelter, spawning area and prey items.

Marine Mammals: Under the Preferred Alternative, marine mammals should indirectly benefit through the protection of prey species. No adverse impacts on marine mammals would be expected under the Preferred Alternative.

Terrestrial Wildlife: Similar to marine mammals, the majority of the benefits for terrestrial wildlife would be through the protection of prey species such as herring and crabs. However, species such as Western Grebe are also dependent on the area for shelter from winter storms, and as such the Preferred Alternative would provide protection for nearshore areas used as shelter.

These indirect benefits to bird species could increase bird use of the area, which could lead to increased predation on forage fish in the area. However, this potential effect would likely be negligible.

4.4.2.2 Alternative 2 (Repeal the Reserve)

Alternative 2 would have a moderate probability of causing negative direct impacts to plant and animal species and communities at discrete locations throughout the site

and negative indirect impacts to plant and animal species and communities in and around the site.

Repealing the reserve has the potential to further degrade the plant and animal resources discussed above. Without a comprehensive plan to protect the area, it can be expected that as shoreline development increases, so would eutrophication from non-point source pollution, which would decrease the euphotic zone, eelgrass, and kelp beds. As eelgrass and kelp decrease so would the communities that depend on them directly (i.e., anemone, sea star, algae) and indirectly for food and shelter (i.e., salmonids, forage fish, piscivorous mammals and birds). Use authorizations would be granted by DNR on a case-by-case basis, with little systematic or standardized method to address the cumulative impacts. In addition, shoreline armoring may increase because DNR would not be actively eliciting cooperative assistance to address it, which may lead to, and exacerbate, shoreline erosion and further decreases in the supply of fine-grained sediments utilized for forage fish spawning. King County would be solely responsible for the development, funding, and implementation of any and all protection beyond regulatory minimums.

4.4.2.3 Alternative 3 (No Action)

Alternative 3 would have a low probability of causing positive direct impacts to plant and animal species and communities at discrete locations throughout the site and positive indirect impacts to plant and animal species and communities in and around the site.

As in Alternative 2, leaving the reserve status in place without developing a proactive management plan would not systematically address or protect the plant and animal resources discussed above. Use authorizations would be considered when they are proposed and those uses that do not conflict with the purpose of the reserve would be allowed to occur. Without a comprehensive plan to protect the area, DNR would rely on the programmatic FEIS and existing RCWs and WACs for guidance when issuing use authorizations within the site. This increased scrutiny (more than if there were no reserve, less than if there were a management plan) would likely benefit the plant and animal species described above in a similar, but less intense and less comprehensive manner than under the Preferred Alternative.

Without specific guidance for the Maury Island site, DNR's activities would likely be focused on uses of state-owned aquatic lands instead of seeking voluntary cooperation for activities on private property (as would be the case under the Preferred Alternative). This may cause increases in activities such as shoreline armoring, which would exacerbate shoreline erosion and further decrease the supply of fine-grained sediments utilized for forage fish spawning. King County would be solely responsible for the development, funding and implementation of any and all protection beyond regulatory minimums.

4.5 Energy and Natural Resource Use

Under SEPA, the energy and natural resources analysis in an EIS is to evaluate potential effects on sources and availability of energy and natural resources (e.g., fish, shellfish), nonrenewable resources, conservation of renewable resources, and scenic resources. Within its authority to manage state-owned aquatic lands, DNR can allow uses that may impact these energy and natural resources. Examples of uses that may impact these resources include allowing a use that obstructs a view corridor or dredging substrate from state-owned aquatic lands.

4.5.1 Affected Environment

The Maury Island site is not actively used for the extraction of energy resources. However, Puget Sound Energy has easements that traverse the Maury Island site along the northeastern shoreline (Appendix J). These easements are for submarine cables that provide electricity and natural gas to Maury and Vashon islands. The easements for the cable crossings are valid in perpetuity, as described in Section 4.7.1.4.

The site contains a number of commercial geoduck tracts, which provide a potential renewable natural resource for use by the state, although no state commercial harvests are presently conducted or proposed in the area. However, the Puyallup Tribe is commercially harvesting geoduck along the southeastern shoreline of Maury Island in accordance with Tribal harvest policies. The Maury Island site also provides recreational geoduck harvest opportunities throughout the area. In addition to geoducks, recreational harvest of other shellfish species, such as manila clams, occurs throughout the Maury Island site.

Commercial and recreational harvest of herring and smelt also occurs within or near the Maury Island site, however DNR does not regulate such activities. Harvest of fisheries resources, both commercial and recreational, is under the authority of WDFW and the Tribes.

The Maury Island site is primarily rural residential and scenic resources are relatively intact. However, structures within the Maury Island site, such as old piers, derelict vessels, and poorly maintained over-water structures, may be impacting the scenic resources of the area, although no reports of scenic resource degradation in the area have been received by DNR.

Before addressing possible impacts caused by an aquatic reserve designation, it is important to state that DNR does not have complete authority over all activities that take place on state-owned aquatic lands. As such, activities may take place within and outside of the Maury Island site that DNR cannot lawfully control. These activities may contribute to the degradation of energy and natural resources regardless of DNR's management efforts. The significant adverse impacts that may result to the state's energy and natural resource use from this proposed action are described below.

4.5.2 Impact Analysis

4.5.2.1 Alternative 1 (Preferred Alternative)

The Preferred Alternative would have no impact on energy delivery or consumption in the area. Alternative 1 would have a moderate probability of resulting in positive direct, indirect, and cumulative impacts to renewable natural resource use in the area, but would have a moderate to high probability of producing negative direct and indirect effects on extraction of non-renewable natural resources within the reserve.

No provisions of the management plan would disrupt the delivery of electricity and natural gas to the area, which is conveyed by the existing Puget Sound Energy submarine cables. The management plan proposed for the environmental aquatic reserve under this alternative contains no provisions relating to energy consumption or conservation of energy resources. Furthermore, the management plan does not propose any activities that would increase energy consumption or hinder energy conservation efforts. Therefore, the Preferred Alternative would have no impact on energy consumption or energy conservation in the area. The preferred alternative would have a moderate probability of negatively impacting future energy related facilities in the area by potentially limiting the suitable locations or methods of construction. However, no additional energy facilities have been proposed on state-owned aquatic lands in the area and the alternative does not prohibit construction of new underwater cables. Thus the potential impact on energy resources associated with the preferred alternative would be negligible.

The Preferred Alternative would have a moderate probability of causing direct, indirect and cumulative positive impacts to some renewable natural resources within the site and the surrounding area. For example, the management plan includes provisions to protect and improve water quality and decrease the impacts of human development in the area. The geoduck harvest tracts along the western shore of Quartermaster Harbor are currently decommissioned due to fecal coliform and PSP concerns (Appendix I). Measures in the management plan could improve existing conditions for geoduck, which could ultimately lead to increased geoduck populations in the area. This population increase could in turn lead to improved state commercial harvest opportunities. Such activities would also benefit other shellfish in the area, such as oysters.

At present, the state has no plans to conduct commercial geoduck or other shellfish harvest within the Maury Island site. Under the management plan, if such activities were proposed, DNR would first have to assess whether harvest could be conducted without conflicting with the basis for reserve designation or damaging the primary habitats and species identified in the management plan. If the assessment limited state shellfish harvest in the area, this would produce a negative impact on state use of renewable natural resources. However, the probability of such restrictions are low, as the State of Washington Commercial Geoduck Fishery SEIS (DNR 2001a) and associated management plan (DNR 2001b) would likely be sufficient to protect the aquatic habitat and species within the Maury Island site from damage resulting from

shellfish harvest. The Puyallup Tribe would continue to harvest shellfish in the area under existing Tribal harvest policies.

The management plan stresses the maintenance of aquatic vegetation and water quality, which are crucial habitat components for herring in the area. These measures could increase herring abundance, which could improve the existing herring fishery in Quartermaster Harbor that occurs annually from May through September.

Maintaining aquatic reserve status and implementing the proposed management plan could also contribute to preservation of the relatively natural aesthetic character of the Maury Island site, as it could preclude high impact land uses, remove derelict vessels and improve or remove poorly maintained over-water structures in the area. It is important to note that the upland areas, which have the most opportunity to impact scenic resources, are not under the control of DNR.

The proposed management plan could preclude future activities that would extract non-renewable resources, such as substrate, from state-owned aquatic lands. The management plan states that authorized activities must cause no degradation of existing habitats and species. Therefore, an activity such as bedload removal may not be permitted within the reserve as it would likely result in at least short-term modifications to water quality, which could impact aquatic resources in the area. Extraction activities could also adversely impact aquatic vegetation within the Maury Island site, disrupt drift cell functions, and could also impact commercial fisheries (i.e., geoduck). Thus, implementation of the proposed management plan would have a high probability of reducing future opportunities for non-renewable resource extraction from the state-owned aquatic lands at the Maury Island site. There are no current or proposed non-renewable resource extraction activities within the Maury Island site; therefore, the direct negative impact to resource extraction activities from implementing the management plan would likely be negligible.

Maintaining the reserve designation and implementing the proposed management plan could produce an adverse indirect impact in areas outside the reserve, as the prohibition of such uses at the Maury Island site could result in a higher concentration of extraction efforts in other areas to meet public demand. This could lead to the decline of non-renewable resources in areas outside of the aquatic reserve. Yet, as the Maury Island site is relatively small and is not currently used for non-renewable resource extraction, the potential indirect impacts on other areas due to the prohibition of such activities within the reserve would likely be immeasurable.

4.5.2.2 Alternative 2 (Repeal the Reserve)

Alternative 2 would have no impact on energy resources in or around the site. Alternative 2 would, however, have a moderate probability of causing indirect and cumulative negative impacts to some renewable natural resource uses in and around the site.

Under this alternative, the Maury Island site would no longer be designated as an environmental aquatic reserve. Rescinding the reserve designation would not have a direct effect on the consumption or conservation of energy resources in the area. The existing Puget Sound Energy submarine cables, which provide electricity and natural gas to the area, would remain in place under the conditions of the current use authorization.

The Maury Island site would be managed in a similar manner as the rest of the state-owned aquatic lands for which DNR is the steward on behalf of the citizens of the state. Therefore, use authorizations for construction of energy related facilities or the extraction of non-renewable resources, such as substrate, would potentially be a permissible action. Authorization for such activities would be made in accordance with existing land management guidance. It would still be possible for DNR land managers to consider the environmental resources in the area and deny or condition use proposals due to adverse impacts on the aquatic environment, but there would be no formal framework guiding such decisions. This could also contribute to less consistency in use authorizations. As extraction of non-renewable resources would be permissible under this alternative there would likely be no impact on this type of use resulting from Alternative 2.

The DNR would continue to manage the renewable resources in the area (i.e., shellfish) to provide for the health of populations and sustainable harvest opportunities. However, there would be no formal directive for DNR to collaborate with the regulatory entities (i.e., WDFW, King County, Ecology), landowners, and recreational users to improve water quality and reduce human disturbances in the area making it less likely that such collaborative efforts would be made. Without such relationships bringing focus to the aquatic environment of the Maury Island site, it is likely that human activities would continue to produce negative impacts on the health and abundance of natural resources, such as geoducks and other shellfish within the area. There is also a moderate probability under this alternative that shellfish closures related to human-induced causes would persist, which would adversely impact use of these renewable resources in the Quartermaster Harbor area. Limited shellfish harvest opportunities in the Quartermaster Harbor area could lead to adverse indirect impacts to other areas of Puget Sound, which could experience higher levels of shellfishing pressure to meet demand.

Without the reserve designation, there would be limited efforts on the part of DNR to protect aquatic vegetation at the Maury Island site. Without specific management provisions related to aquatic vegetation, use authorizations could be issued that would degrade aquatic vegetation in the area, which could ultimately adversely impact the Quartermaster Harbor herring fishery. However, both WDFW and the Army Corps of Engineers, which have regulatory authority over many activities that could occur in the waters covering state-owned aquatic lands, have implemented management provisions for the protection of aquatic vegetation, namely eelgrass. Yet, without formalized directives for DNR to work proactively with regulatory entities in the management of the site, there would likely be a moderate probability of adverse

impacts on aquatic vegetation in the area, which could produce an indirect negative impact on the Quartermaster Harbor herring fishery and contribute to cumulative impacts to the Puget Sound herring fishery as a whole.

Repealing the reserve designation would not likely produce a significant impact on the scenic resources of the Maury Island site. Yet, it would be more likely, than under the Preferred Alternative, that more intensive activities, such as non-renewable resource extraction would be authorized, which are less compatible with the relatively natural character of the area.

4.5.2.3 Alternative 3 (No action)

The effects of the No Action Alternative on energy and natural resources would be similar to those explained for the Preferred Alternative, although it may actually result in increased restrictions on proposed new uses of energy and natural resource in the area. The Maury Island site would continue to be considered an environmental aquatic reserve and the programmatic FEIS (along with applicable RCWs and WACs) would guide how the reserve designation influenced DNR use authorizations. This alternative would have no impact on energy consumption or conservation in the Vashon-Maury Island area. The existing Puget Sound Energy submarine cables in the area would continue to provide electricity and natural gas to the area. There would be a low probability of positive direct, indirect, and cumulative impacts to renewable natural resource use and a low probability of direct negative impacts on state harvest of shellfish within the site. Alternative 3 would also have a high probability of adversely impacting extraction of non-renewable resources from state-owned aquatic lands within the Maury Island site.

The manner in which DNR evaluates applications for construction of energy related facilities or extraction of non-renewable resources on state-owned aquatic lands would be rather strict and there would be a moderate probability of negative impacts in relation to new use proposals. No energy or mineral extraction activities would be allowed if they would alter, remove, and/or otherwise change the existing environmental or cultural characteristics of the Maury Island site, although the programmatic FEIS does not detail the specific environmental or cultural characteristics of concern. As extraction activities usually involve ground-disturbing activities that may impact environmental or cultural resources, such uses would not likely be permitted within the reserve boundary. This would have a high probability of negatively impacting non-renewable resource use in the area. However, no proposals to extract energy or non-renewable natural resources from the Maury Island site have been identified.

Similarly, the management of renewable resources, such as shellfish and aquatic vegetation that supports herring populations would be strictly managed. As per the programmatic FEIS, state commercial harvest of shellfish would not be permitted within the reserve unless the activity could demonstrate that it would not adversely impact the aquatic resources within the reserve. This could adversely impact the

potential for state commercial geoduck harvest within the Maury Island site, although the added protection would benefit the actual geoduck populations in the area.

Potential restrictions on commercial harvest of shellfish within the reserve boundary could produce an indirect adverse impact on geoduck harvest tracts in other areas of the state, which might experience increased harvest efforts to meet demand. However, the probability of such restrictions are low, as the State of Washington Commercial Geoduck Fishery SEIS (DNR 2001a) and associated management plan (DNR 2001b) would likely be sufficient to protect the aquatic resources within the Maury Island site from damage resulting from shellfish harvest. It is important to note that potential restrictions under the No Action alternative would only apply to state commercial harvest of geoducks. The Puyallup Tribe would continue to harvest shellfish in the area under existing Tribal harvest policies.

The No Action Alternative could benefit the commercial herring fishery by protecting the aquatic vegetation upon which the species depends. The programmatic FEIS would not permit use authorizations that would damage aquatic vegetation within the Maury Island site. The preservation of aquatic vegetation could in turn increase herring populations, which would benefit harvest of this renewable natural resource.

Maintaining the reserve designation under the programmatic FEIS could produce a minor beneficial impact to scenic resources. The more strict aquatic land management practices that would be implemented under this alternative would likely preclude substantial infrastructure development on the state-owned aquatic lands within the reserve boundary. This would help to ensure that viewsheds were preserved and that the natural aesthetic of the Maury Island area was preserved.

4.6 Environmental Health

Aspects of environmental health that may be affected by the proposed alternatives include: noise generated by activities of lessees on state-owned aquatic lands and releases of foreign materials (such as toxic and hazardous substances) from outfalls, shoreland and tideland industries, or marinas.

4.6.1 Affected Environment

The Maury Island site is located in a relatively rural area. The only industrial use in the vicinity is the existing gravel mine located on uplands along the eastern shore of Maury Island. Glacier Northwest is currently working toward permitting an expansion of this gravel mine that would include a new pier and dock structure on approximately 2.31 acres of state-owned aquatic lands. If this activity were authorized, there could be noise in the area and a risk of hazardous material introduction, primarily associated with construction and construction materials and spills of gravel material or fuels and hydraulic fluids from barges. To obtain a use authorization in the area, Glacier Northwest would be required to utilize current technologies associated with the design of the gravel barge loading facility. In addition implementation of BMPs would be required during construction and operation to reduce and compensate for the potential effects on environmental health.

In addition to the Glacier Northwest facility, there are at least 84 other overwater structures within the Maury Island site including two commercial marinas and one public marina (Anchor 2004). There are also numerous floating structures, mooring buoys, and boat ramps within the Maury Island site. There is a potential for introduction of waste, fuels, and/or hydraulic fluids in these locations where boats are moored. In addition, creosote or other wood treatment chemicals used on the pilings of over-water structures could contribute to water and sediment contamination.

Failing residential septic systems along Quartermaster Harbor has led to the closure of some commercial shellfish areas and one commercial geoduck tract. In addition, high levels of PSP have been documented in Quartermaster Harbor. Consumption of contaminated shellfish poses a potential human health concern.

There may also be numerous stormwater and other outfalls that discharge into the Maury Island site, although DNR does not have a full inventory of these facilities at this time. Such outfalls could introduce toxic and hazardous substances into the aquatic environment.

4.6.2 Impact Analysis

4.6.2.1 Alternative 1 (Preferred Alternative)

The Preferred Alternative would have a moderate probability of causing direct and indirect positive impacts to environmental health at discrete locations throughout the site. Maintaining, reducing, and/or preventing noise and releases of foreign materials to areas within the site may realize possible improvements to environmental health.

Under the management plan, prior to authorization of the pier and dock expansion at the Maury Island gravel mine site, Glacier Northwest would need to demonstrate that the proposed activity would not result in a net loss of habitats and species identified for conservation in the management plan. This would include implementing appropriate BMPs to eliminate or minimize noise and prevent potential introductions of hazardous substances to the aquatic environment. Implementation of such BMPs would also likely be a requirement of regulatory permits needed for the expansion (e.g., local shoreline permits, hydraulic project approval, 401 certification, and U.S. Army Corps of Engineers' (Corps') permits). In addition, DNR would have the ability to require supplementary protective provisions if deemed necessary to further protect environmental health and the integrity of the aquatic environment at the Maury Island site. The use of current technologies for construction of the barge loading facility and implementation of BMPs would be expected to effectively eliminate or minimize the potential for adverse impacts to environmental health associated with the gravel barge loading facility, although no technology could completely alleviate the possibility of such impacts.

Under the management plan, DNR would work with lessees, such as Glacier Northwest, Quartermaster Yacht Club, Polaris Development, and King County, to develop actions to avoid and minimize potential adverse impacts resulting from their

operations over time, including those affecting environmental health. Such actions may include reducing the number of treated wood pilings or improving pump out facilities, which would help protect environmental health in the area. However, the need for such activities has not been fully evaluated; therefore, the specific activities that may be implemented under the preferred alternative to protect environmental health in the area are not fully defined at this time.

For any potential new uses within the Maury Island site, the management plan provides management strategies that would have a high probability of maintaining or improving environmental health in the area. For example, the management plan calls for the preclusion of construction of stormwater or sewage outfalls within Quartermaster Harbor on state-owned aquatic lands, which would help to protect water and sediment quality. These protective measures would not necessarily be implemented without the reserve designation and management plan. Further, the proposed management plan directs DNR to remove any trespass structures that are adversely impacting the aquatic reserve. Such activities could benefit aquatic health in the area. For example, a derelict dock structure may contain chemically treated wood pilings. The removal of these structures would reduce the introduction of pollutants to the site.

The management plan also states that DNR would work to identify threats to aquatic resources related to outfalls and non-point sources (i.e., stormwater runoff and failing septic systems) and would conduct inventory and monitoring activities that would help to identify such threats. Further, the Preferred Alternative provides for adaptive management of the site to ensure that management strategies could be adopted to address threats to environmental health as they were identified.

However, DNR does not have management authority over upland point and non-point pollution sources. Thus, the proposed management plan states that DNR would work cooperatively with the King County Health Department, other pertinent agencies, and local landowners to develop a strategy for dealing with water quality impacts within the reserve. Such cooperative relationships would be entirely voluntary, but it is likely that such efforts would reduce the levels of point and non-point pollution entering the Maury Island site.

4.6.2.2 Alternative 2 (Repeal the Reserve)

Alternative 2 would have a moderate probability of causing direct and indirect negative impacts to environmental health at discrete locations throughout the site. Under Alternative 2, there would be uncertain, but likely negative, effects on environmental health related to potential noise and releases of foreign materials to the aquatic environment. The high level of uncertainty of environmental health impacts associated with this alternative is mainly due to the absence of a site-specific management plan that would guide DNR actions in the area.

Without the reserve designation, Glacier Northwest would still have to implement BMPs to minimize noise and prevent potential introductions of hazardous substances,

as such measures would be required under the regulatory permits needed for the pier and dock expansion (e.g., local shoreline permits, hydraulic project approval, 401 certification, and Corps' permits). In addition, DNR land managers would maintain the ability to require additional provisions for use authorizations if deemed necessary for the protection of environmental health and aquatic resources at the Maury Island site. The likelihood that additional measures would be required for a given action is uncertain. The use of current technologies for construction of the barge loading facility and implementation of BMPs would be expected to effectively minimize the potential for adverse impacts to environmental health associated with the gravel barge loading facility, although no technology could completely alleviate the possibility of such impacts.

Under Alternative 2, it is unlikely that DNR would work with existing lessees to develop actions to avoid potential impacts on environmental health, aside from when applications for new uses or reauthorizations are submitted. Therefore, there is a moderate probability that any ongoing adverse impacts associated with the operations and facilities of existing lessees would continue under this alternative. Yet, since no immediate threats to environmental health resulting from the uses of existing lessees have been identified, the potential impacts for Alternative 2 are uncertain.

Under Alternative 2 it is unlikely that DNR would definitively preclude certain uses from occurring in areas of the Maury Island site as would occur under the Preferred Alternative. Therefore, there would be a moderate probability that uses such as stormwater or sewage outfalls, for example, would be permitted within Quartermaster Harbor. These types of uses could produce adverse impacts on environmental health throughout the Maury Island site. Without specific guidance to do so, it is also unlikely that DNR would proactively inventory and remove trespass structures within the reserve. Thus, there is a moderate probability that any adverse impacts on environmental health associated with these structures, such as pollutant introduction from chemically treated wood pilings, would likely continue under this alternative.

It is also unlikely without the reserve designation and management plan that DNR would proactively work with King County and other agencies to identify potential point and non-point pollution sources and develop strategies for addressing impacts on environmental health. If such relationships were not developed, existing environmental health conditions at the Maury Island site would not improve and there would be a moderate probability that conditions may worsen.

4.6.2.3 Alternative 3 (No Action)

There is moderate probability that Alternative 3 would result in direct and indirect positive impacts to environmental health in the area, as DNR would be more deliberate in its evaluation of the potential environmental impacts of proposed projects in the area. Alternative 3 would have a moderate probability of lending to indirect negative impacts to environmental health (related to potential continuing impacts from trespass or derelict structures, non-point pollution, etc.).

Under this alternative it is uncertain how DNR would consider potential impacts on environmental health resulting from authorization of the proposed Glacier Northwest pier and dock expansion. As part of the regulatory permits needed for the project (e.g., local shoreline permits, hydraulic project approval, 401 certification, and Corps' permits), Glacier Northwest would be required to implement BMPs to reduce potential impacts on environmental health. It is uncertain whether DNR would exercise the authority to require additional provisions to protect environmental health. However, the programmatic FEIS states that no use authorization would be granted if it would degrade existing environmental conditions. Thus, it could be assumed that a use authorization issued to Glacier Northwest under this alternative would be protective of environmental health. Further, Glacier's proposal includes the use of current technologies for construction of the barge loading facility and implementation of BMPs and would be expected to effectively minimize the potential for adverse impacts to environmental health associated with the gravel barge loading facility. Yet, no technology could completely alleviate the possibility of such impacts.

Under Alternative 3, it is unlikely that DNR would proactively collaborate with existing lessees to develop actions to avoid potential impacts on environmental health, aside from when applications for new uses or reauthorizations were submitted. However, when new uses or reauthorizations were proposed, the proponent would be required to ensure that their use of state-owned aquatic lands would not adversely impact the environmental resources of the reserve, which would include environmental health. Thus, if existing uses, such as the marinas, proposed expansion or needed reauthorization, they would likely be required to implement actions such as removing treated wood pilings or improving pump-out facilities, which would produce positive impacts on environmental health.

Under the No Action Alternative it is unlikely that DNR would definitively preclude certain uses from occurring in areas of the Maury Island site as would occur under the Preferred Alternative. However, no use would be authorized if it would degrade environmental conditions of the site. Thus, on a case-by-case basis, there is a moderate probability that DNR land managers would prohibit certain uses from occurring within the reserve, which could benefit environmental health in the area.

Under No Action, it is also unlikely the DNR would proactively inventory and remove trespass structures within the reserve. Thus, there is a moderate probability that any adverse impacts on environmental health associated with such structures, such as pollutant introduction from chemically treated wood pilings, would likely continue under this alternative.

Without a site-specific management plan directing DNR to proactively collaborate with King County and other entities to reduce potential threats of point and non-point pollution on the aquatic reserve, it is unlikely that such actions would be taken. The programmatic FEIS states that DNR must work with local jurisdictions and regulatory agencies to minimize offsite impacts, but environmental health is not explicitly discussed. Therefore, it is unlikely that DNR would work with King County and other

entities to reduce potential environmental health concerns related to non-point pollution and there is a moderate probability that any existing negative impacts on environmental health that may be occurring as a result of such pollution would continue.

4.7 Land and Shoreline Use

Aspects of land and shoreline use that may be affected by the action alternatives include: regional planning, shoreline modification, existing land uses, existing and proposed DNR use authorizations, and historical and cultural resources.

4.7.1 Affected Environment

4.7.1.1 Local Planning

The major issue in considering the relationship between the management of the Maury Island site and existing local land use plans is the coordination between DNR and the local (private and public) entities that have developed land use plans or that have existing, historic, or planned uses of state-owned aquatic lands.

The King County Comprehensive Plan designates Maury and Vashon islands as rural areas and these lands are not included in the county's urban growth area (King County 2002). With such a designation, King County asserts that for at least the next 20 years, urban levels of development are not appropriate at this location. In 1997, Maury and Vashon islands together were estimated to have a year-round population of roughly 10,500 people. Transportation to and from the mainland for residents and visitors to the islands is primarily by passenger/automobile ferry (not located within the Maury Island site) or by private boat.

The King County Comprehensive Plan land use map designates the majority of the lands adjacent to the Maury Island site as rural residential, meaning that they are to have one dwelling unit per 2.5 to 10 acres. The land use maps also designate as "open space" the lands that support park facilities such as Burton Acres, Dockton, Maury Island Marine, and Point Robinson parks. All of the 235 acres along the southeastern shoreline owned by Glacier Northwest are designated for mining land uses (King County 2002).

The King County Shoreline Master Program identifies the shorelines within the Maury Island site as "conservancy" and "rural" (Appendix K). These shoreline designations are consistent with the low density, rural zoning for the area. The purpose of the "rural" environment designation is to "restrict intensive development, function as a buffer between urban areas, and maintain open spaces and opportunities for recreational uses, within the ecological carrying capacity of land and water resources." "New developments in a rural environment should reflect the character of the surrounding area by limiting intensity, providing permanent open space and by maintaining adequate building setbacks from water to prevent shoreline resources from being destroyed for other rural types of uses" (King County Code 25.20.010). The majority of the areas within the Maury Island site are consistent with the regulations for the rural environment, although review of aerial photography of the

site suggests that some residences along the shoreline may not provide the full 25-foot buffer between the ordinary high water mark and the residence, as required by K.C.C. 25.16.100. Many of these residences within the buffer were likely constructed prior to adoption of the King County Shoreline Master Program.

The purpose of the conservancy environment designation is to maintain the existing character of the lands. The designation is "designed to protect, conserve, and manage existing natural resources and valuable historic and cultural areas" (King County Code 25.24.010). Preferred uses in these areas are non-consumptive of physical and biological resources. Single-family residences are permitted in conservancy areas, but they must maintain a 50-foot setback from the ordinary high water mark. Some structures in the area do not conform to this standard, although the residences may have been constructed prior to adoption of the King County Shoreline Master Program or may have secured a variance or conditional use permit.

The main congregations of residences in the vicinity of the Maury Island site are at Gold Beach and Sandy Shores (along the eastern shoreline of Maury Island) and at Dockton and Burton (which are adjacent to Quartermaster Harbor). These areas were primarily developed prior to King County comprehensive planning and zoning, which provides for densities of one dwelling unit per 2.5 to 10 acres (Appendix L).

4.7.1.2 Shoreline Modification

Shoreline modification includes all human activities that have altered the natural state of the Maury-Vashon Island shoreline. Such modifications may include residential and industrial upland development, shoreline armoring, over-water structures, bank stabilization efforts, and other forms of human development. As population and development increases throughout the Puget Sound region, the level of shoreline modification tends to also increase. In the central Puget Sound basin as a whole, approximately 59 percent of the shorelines have been modified by human development, with about 18 percent of the shorelines being modified to the extent that they are now considered man-made. Maury Island has experienced approximately the same level of overall shoreline modification (60 percent), although none of the areas in the reserve site have been modified to the point that they are regarded as man-made (Appendix M) (Nearshore Habitat Program 2001).

4.7.1.3 Existing Land Uses

The Vashon-Maury Island area was first homesteaded in the mid-1800s. Early land uses in the area included logging, lumber processing, farming, ship building and repair, brick making, and shingle making (Haulman 2002). The majority of Vashon and Maury Islands was originally cleared of old growth vegetation by the early 1920s. Since that time, approximately three fifths of the islands have been reforested and parceled out to thousands of different landowners, although King County has not formally zoned any of Vashon or Maury islands as forest production areas.

The vast majority of the land is currently used for residential purposes and small-scale agriculture. There are a number of parks and open spaces, which are further

described in Section 4.9.1 (Services and Utilities). The area is devoid of substantial commercial development and the only existing industrial use is the Glacier Northwest gravel mine located on uplands on the southeastern shore of Maury Island (King County 2002).

Quartermaster Harbor and the surrounding area is an important regional recreation area. Activities such as water-skiing, kayaking, fishing, shellfish harvesting, sailing, beach walking, and power boating are predominant throughout the harbor and to a lesser extent along the eastern shoreline of Maury Island.

4.7.1.4 Existing and Proposed DNR Use Authorizations

Quartermaster Yacht Club: The Quartermaster Yacht Club is a non-profit organization that provides private boat mooring. The yacht club has 94 slips, although only approximately 92 of the slips are located within the 2.97-acre area of the DNR lease (Agreement Number 20A11434). In addition, there are approximately 200-feet of dock that provides transient moorage to members of other yacht clubs with which the Quartermaster Yacht Club has reciprocal agreements. The yacht club is currently filled to capacity and has a waiting list for individuals that wish to join. Thus, the owners are considering expansion of the facility to meet demand for slips. The facility currently offers an on-site pump house for use by the Club's members. Effluent from the pump house is directed to a storage tank, which is emptied and disposed of by a contracted operator. The current lease of the yacht club expired on January 9, 2001, and has been in holdover status since that date, pending the decision on how the state-owned aquatic lands at the Maury Island site should be managed. Since 2001, the yacht club has been operated on a year-to-year agreement with DNR based upon the conditions of the original lease.

Polaris Development, LLC – Quartermaster Harbor Marina: The Quartermaster Harbor Marina, owned and operated by Polaris Development, LLC is under a DNR lease (Agreement Number 20010075) for the use of 3.09 acres of state-owned aquatic lands. The marina consists of a 65-slip structure that supplies private, permanent mooring. The marina provides portable pump units for the use of its clients. These pump units are then emptied into the Marina's drain field. A permanent pump house is not provided at the site to ensure that fuel or hydraulic fluids do not contaminate the drain field. The current authorization for the use of state-owned aquatic lands expires on November 14, 2004. Polaris may be seeking to expand the marina under the new lease to provide approximately 35 additional slips. Any expansion to be undertaken would be within the current boundary of the existing lease. An expansion is being considered by the marina owners to accommodate increasing demand.

King County Parks – Dockton Area Pier and Boat Dock: King County and DNR have entered into an interagency agreement (Agreement Number 20009814) for the use of 0.81 acres of state-owned aquatic lands for the purposes of a public pier and boat dock. The boat dock provides 58 slips for transient small boat moorage and a utility building that includes restroom and laundry facilities. All sewage from the utility building is pumped to an upland facility. The pier is a wood and concrete

structure primarily suspended by wooden piles, with a wooden deck on Styrofoam floats for the mooring slips. There is a concrete seawall along the shoreline of the majority of the park. The park also includes a public boat ramp to the west of the pier. The current authorization for the use of state-owned aquatic lands expires in 2012.

Glacier Northwest – Maury Island Gravel Barge Loading Facility: Glacier Northwest's Maury Island gravel mine is located on uplands along the southeastern shoreline of the island between the communities of Gold Beach and Sandy Shores. The mine is immediately adjacent to the state-owned aquatic lands included within the proposed reserve boundary. Mining has occurred on the site since the early 1940s. The upland site is comprised of approximately 235 acres of which only about 40 acres have been disturbed by previous mining activities. Mining is currently permitted on the site under King County Grading Permit No. 1128-714 and DNR Surface Mining Reclamation Permit No. 1128-714. These permits allow mining on approximately 193 acres of the site. The site contains a portable screening plant, dock, and conveyor system. Current mining activities consist of sand and gravel extraction for local use. Approximately 10,000 tons per year have been extracted from the site under the existing grading permits. However, removal of gravel from the site has not occurred via the existing dock and conveyor system located on state-owned aquatic lands within the Maury Island site for over 20 years.

In 2000, a use authorization application was submitted by Glacier Northwest to DNR to replace the existing pier, dock, and conveyor system located on state-owned aquatic lands in order to undertake more intensive gravel extraction activities at that site. The application was denied at that time. Since the original application, Glacier has made many improvements to the project design and may continue to pursue a use authorization from DNR for the use of state-owned aquatic lands in the area. Glacier's current proposal is to rebuild the existing loading dock, which would moor up to four, 10,000-ton barges (330 feet long by 80 feet wide) or a greater number of smaller barges per day during the 11 to 50-year period that mining could be conducted at the site (King County 2000). The new proposal includes many design improvements and BMPs that improve the mitigation plan for the project in comparison to the 2000 proposal.

All local, state, and federal permits would have to be secured prior to consideration by DNR of this activity at the Maury Island site. King County (2004) recently denied Glacier Northwest their shoreline substantial development permit (DDES File Number L02SH012) and shoreline conditional use permit (DDES File Number L02SH013) for this revised project. The King County decision is being appealed to the Shoreline Hearings Board. At the time this plan was printed, the future of the new barge loading facility was uncertain.

Puget Sound Energy – Utility Rights of Way: Puget Sound Energy has three right-of-way agreements for submarine cables (Agreement Numbers 51021507, 51027510,and 51033836). These cables cross the Maury Island site along the northeastern shoreline. The cables are used for telecommunications, power, and

natural gas, which are important services for the residents of Vashon and Maury islands. The authorizations of the use of these state-owned aquatic lands are valid in perpetuity.

Comcast – Utility Right of Way: Comcast has proposed the installation of a sub-marine fiber optic cable that would provide cable, video, and high-speed internet services to Vashon and Maury islands. The proposed cable would traverse state-owned aquatic lands along the northern shoreline of Maury Island. A right-of-way would need to be obtained from DNR for this use of state-owned-aquatic lands.

4.7.1.5 Historical and Cultural Resources

The following sites of historic or cultural importance have been identified. None of the resources identified are within the boundaries of the Maury Island site, but are located on tidelands or uplands adjacent to the site:

- Robinson Point Lighthouse: Located at the northeast corner of Maury Island is on the National Register of Historic Places. The Lighthouse was originally constructed as a fog signal in 1885 and re-constructed in 1915.
- Historical portage from the northeast corner of Quartermaster Harbor to Puget Sound: This site is not registered on a historic register. When the portage was still submerged at high tide, the area was a popular Tribal fishing and hunting ground. Nets in this area were used to capture abundant waterfowl (Larkin 1975).
- Historic clam middens: Historic clam middens were excavated on the north shore of the Burton Peninsula in 1996 by University of Washington's Department of Archaeology (Joseph 1996).

In addition, the Maury Island site is located within the Puyallup Tribe's exclusive usual and accustomed area.

4.7.1.6 Consistency with Other Pertinent Regulations

Projects in the aquatic environment are subject to a complex matrix of local, state, Tribal, and federal authorities and regulations. For this reason, new actions proposed by DNR must not only be compatible with existing DNR aquatic land statutes and regulations, but also must be compatible with other local, state, Tribal, and federal regulatory requirements.

The proprietary authority of DNR with respect to activities within navigable waters comes from a different perspective than the regulatory authorities. The DNR acts as a land manager of state-owned aquatic lands for the citizens of the state. As with any land ownership, activities on land managed by DNR are subject to all of the authorities referenced below. If however, in its role as a steward of the public trust DNR identifies a specific need or land use issue that would not be adequately served by the minimum requirements of the regulatory authorities, it may condition or

withhold its land use authorizations (such as leases, easements, and rights of entry) to provide for additional protection (RCW 79.90.460 (3)).

The following is a brief overview of major regulatory authorities and statewide planning efforts affecting activities on aquatic lands at the Maury Island site:

- King County issues Shoreline Substantial Development Permits, Shoreline Variances, and Conditional Use Permits under the Shoreline Management Act and develops Critical Areas Ordinances under the Growth Management Act. These are delegated authorities under the direction and oversight of Ecology.
- Ecology implements portions of the Clean Water Act through permit processes such as National Pollutant Discharge Elimination System (NPDES) permits for discharges of waste and storm water and Water Quality Certification ("401" certification), which certifies that actions subject to federal approvals comply with state water quality standards. In addition, they issue Coastal Zone Management Certifications for federally authorized projects to ensure substantial equivalence to state environmental standards.
- The WDFW issues Hydraulic Project Approvals (HPA) under the authority of the Hydraulic Code (RCW 77.08, RCW 77.55, and WAC 220-110). The purpose of the HPA process is to provide protection for all fish, including the protection of fish habitat. Additionally, WDFW designates "marine protected areas" that impose restrictions on fish harvest.
- At the federal level, the U.S. Army Corps of Engineers issues "404" permits (Section 404 of the CWA) and "Section 10" permits (Section 10 of the Rivers and Harbors Act) for construction, filling, or dredging within navigable waters of the United States. These federal authorities provide for protection of the biological integrity of the nation's waters and protect the rights of navigation, respectively.
- As a result of the listing of certain species of salmon and bull trout under the ESA, the NOAA – Fisheries and USFWS provide "consultations" under ESA for activities which may result in an "incidental take" of threatened or endangered species.

4.7.2 Impact Analysis

4.7.2.1 Alternative 1 (Preferred Alternative)

The Preferred Alternative would have a moderate probability of causing negative direct impacts on land and shoreline uses at discrete locations throughout the site through increased restrictions and requirements for uses of state-owned aquatic lands. This alternative would also have a moderate probability of producing indirect positive impacts by improving management certainty in the area, providing for protection of the natural resources in the area, and helping to ensure development consistent with applicable land use regulations and policies.

Local Planning: The Maury Island Aquatic Reserve designation and proposed management plan would not have a direct effect on upland land uses, which are primarily directed by the King County Comprehensive Plan and Shoreline Master Program, as DNR does not have authority over upland uses. However, these local planning efforts may impact the potential for success of the environmental aquatic reserve, as upland land uses could cause adverse impacts on aquatic resources within the reserve. In addition, some land uses conducted on the adjacent uplands require an aquatic interface for operational purposes (such as Glacier Northwest's gravel mining operation) and would require a DNR use authorization. Activities that require a use authorization and that may impact species and habitat within the reserve would have a moderate probability of experiencing adverse impacts associated with the Preferred Alternative. The effects on these activities may include the costs of additional requirements for use (such as specific design features, BMPs, etc.) for activities occurring within the reserve or, in some cases, a prohibition of certain activities on state-owned aquatic lands.

On a number of occasions[5] King County has expressed its support for DNR's aquatic reserves program and in particular for the Maury Island Aquatic Reserve. In addition, King County has offered to collaborate with DNR in management planning efforts for aquatic reserves within the County, including Maury Island. These collaborative efforts would be consistent with the proposed management plan. For example, the research and monitoring provisions of the proposed management plan recognize the need to partner with King County to coordinate monitoring and research efforts. In addition, the adjacent land uses provisions of the proposed management plan rely on King County and other regulatory entities to manage adjacent lands in a manner compatible with the intent of the aquatic reserve.

This type of collaborative relationship with King County would produce a number of beneficial impacts for both aquatic and upland land uses in the area. A reciprocating relationship and communication between King County and DNR would help to ensure consistency in management strategies so that proponents of new and existing uses would be afforded some level of certainty as to what would be expected of them in using aquatic or upland areas in the reserve vicinity. An inter-agency relationship could also result in cost savings by reducing management redundancies, which would could help to streamline permitting and authorization processes for uses in and adjacent to the Maury Island site.

The aquatic reserve designation is consistent with the majority of King County's planning designations for the site. The King County Shoreline Master Program designations of rural and conservancy for the area are compatible with aquatic reserve designation. The rural designation stresses low density development, recreational use,

[5] February 7, 2001 – letter in support of Maury Island reserve designation from Ron Simms, King County Executive. November 10, 2003 – letter in support of Maury Island reserve designation from Daryl Grigsby, King County Water and Land Resources Division Director. 2004 Amendments to King County Comprehensive Plan 2000 Public Review Draft, November 2003 – Provision E-102a states that King County shall protect and enhance areas designated by DNR as aquatic reserves; King County will also participate in management planning for the reserves.

and recognition of ecological carrying capacity, while the conservancy environment designation is meant to maintain natural and cultural resources. Both of these designations are consistent with aquatic reserve designation, although the conservancy designation, with its goals of protection and conservation (K.C.C. 25.24.010) is more in line with the objectives of the aquatic reserve. In some of the rural designation areas, it is possible that the level of development allowed in the area would be in excess of what would be desirable for protection of the aquatic resources within the reserve. In such instances, having strong interagency communication and local citizen involvement as proposed in the management plan would help in dealing with such potential conflicts to protect the aquatic resources of the reserve, while still providing for the rural levels of development identified by King County as appropriate in the area.

At the locations where existing development is inconsistent with the buffer requirements of the Shoreline Master Program, a working relationship between local citizens, DNR, and King County could help in identifying such areas and implementing voluntary measures (e.g., vegetation buffer maintenance) that may protect or enhance aquatic resources adjacent to the area. Such potential measures could produce short-term adverse impacts to land use due to the costs of implementation, but would ultimately produce benefits, as it would lead to land uses in the area more consistent with the goals and objectives of both King County and DNR planning. In addition, DNR would seek outside funding so that the financial burden of implementing these voluntary activities would not be transferred to landowners adjacent to the aquatic reserve.

Through the adjacent land use provisions of the proposed management plan, DNR could cooperate with King County and local citizens to minimize the potential adverse impacts from existing residential developments that may exceed King County density requirements (i.e., Gold Beach, Sandy Shores, Dockton, and Burton) and help to ensure that future residential developments do not conflict with area zoning and planning efforts. Such actions would have beneficial impacts on land use, as they would help to ensure that the area is developed in a manner consistent with local planning efforts, which would also indirectly benefit the Maury Island Aquatic Reserve.

Shoreline Modification: Alternative 1 would likely have beneficial impacts on shoreline modification at the Maury Island site. As stated previously, DNR does not have the authority to manage upland land uses, including shoreline modifications. Therefore, DNR would primarily rely upon local citizen efforts and the existing permitting authorities (i.e., King County) to ensure adequate protection of these resources. Through interagency and local citizen collaboration, DNR could ensure that agencies and the public are aware of the goals and objectives of the aquatic reserve, and that these issues and concerns are considered in efforts that could modify the shorelines adjacent to the Maury Island site. However, the extent to which interagency and local citizen communication would lead to better management

practices relating to shoreline modification is uncertain, as DNR would not be advocating for new regulations and local landowner involvement would be voluntary.

The proposed management plan, under Alternative 1, states that DNR would collaborate with interested adjacent landowners in an attempt to reduce existing impacts on the aquatic reserve from shoreline modification. This would include education, outreach, and seeking funding opportunities to aid in the implementation of "soft" armoring techniques such as beach nourishment, riparian plantings, and anchored drift logs to reduce shoreline impacts. These techniques would provide bank stabilization and protection for upland landowners while maintaining environmental processes in the area. The potential impacts on adjacent land uses if such activities were successful would be negligible, as they would not physically impact the use of the land and if outside funding were acquired, there would be no additional financial burden on adjacent landowners for implementing these measures. These actions would not directly produce an adverse impact on adjacent landowners that wish to implement or maintain traditional bank armoring structures adjacent to the Maury Island site, as cooperative actions on behalf of landowners would be voluntary. Therefore, if landowners did not want to participate and soften their banks, they would not be required to do so.

Existing Land Uses: Current upland uses in the area are predominated by residences and small-scale agriculture. Reserve designation and the implementation of the proposed management plan would not likely have substantial impacts on such upland uses. The management plan proposes that DNR work with King County to ensure protection of the aquatic resources in the area, although the actual impacts of such collaboration are uncertain, as DNR does not have authority over upland lands uses.

Reserve designation and the proposed management plan would not directly impact recreational uses within the Maury Island site. The DNR has no authority to limit recreational uses such as boating, water-skiing, kayaking, swimming, fishing, or sailing. The DNR also does not have the authority to manage uses such as recreational shellfish harvesting or beach walking on privately owned tidelands, which comprise the majority (approximately 88 percent) of the tidelands located immediately adjacent to the Maury Island site. The proposed management plan suggests the implementation of education and outreach measures to help ensure that recreational activities are conducted in a manner that would not degrade aquatic habitat conditions, but DNR cannot enforce such provisions. Therefore, the effectiveness of these measures is uncertain, but would likely be positive.

Under the Preferred Alternative's proposed management plan, DNR would inventory existing mooring buoys and recreational docks on state-owned aquatic lands to ensure that structures that should be authorized by DNR are reviewed and an appropriate authorization is issued. In addition, DNR would collaborate with owners of recreational docks and mooring buoys that are constructed in a manner that may produce adverse impacts on aquatic resources (i.e., shading and scouring), to decrease potential impacts on the aquatic environment. This action may produce a minor

adverse impact on recreational dock and mooring buoy owners as it may result in the removal of some unauthorized or derelict structures. Improvement or relocation of docks and buoys may result in a short-term, minor financial burden to owners that must implement modifications to protect the aquatic environment. As a mitigating factor, the DNR would seek to minimize these costs and locate funding assistance for projects.

Existing and Proposed DNR Use Authorizations:
Quartermaster Yacht Club: Reserve designation and management plan implementation could produce both positive and negative impacts to the Quartermaster Yacht Club. The lease for the yacht club is currently in holdover, pending the final decision regarding DNR management of the Maury Island site and the club is proposing an expansion of the existing facility under the new DNR use authorization.

The proposed management plan would result in the requirement that the Quartermaster Yacht Club implement measures to cause no new impacts and reduce existing impacts on the aquatic environment over time. The DNR would work collaboratively with the yacht club to develop a site plan that would aid in reducing existing impacts and avoid, minimize, and compensate for potential impacts from maintenance or upgrade activities. However, the implementation of the management plan could result in a minor, short-term adverse impact to the yacht club, as implementing impact reduction measures could require additional expenditures. Yet, overwater design recommendations of the proposed management plan are comparable to the Corps' requirements for a Section 404 permit; therefore, some of the expenditures resulting from structure design and construction costs would likely occur even without reserve designation.

The proposed management plan could also adversely impact the yacht club due to the provision that states that activities undertaken within the reserve must implement actions to benefit the reserve at-large. Such measures could take a variety of forms including: monitoring and research, education and outreach, or enhancement of aquatic habitat. Implementation of such measures could produce a financial burden to the yacht club owners. It is important to note, that expansion of the existing facility without increasing current impacts would actually benefit the reserve as a whole, as it would provide additional moorage for which the public has shown demand, which could decrease the amount of anchor dragging and number of unauthorized mooring buoys within the Maury Island site. Thus, yacht club expansion efforts, if done within the parameters identified in the management plan, would help to serve the objectives of the reserve. The DNR would work with the yacht club to identify additional ways the club's activities could serve the objectives of the reserve.

The reserve designation could also produce positive impacts for the yacht club, as the management plan provisions related to maintaining and enhancing the aquatic environment would indirectly benefit users of the yacht club through the protection of

water quality, fisheries resources, and other aquatic conditions that add to the recreational experience of Quartermaster Harbor.

Quartermaster Harbor Marina: Similar to the yacht club, Polaris Development has plans to expand Quartermaster Harbor Marina. Therefore, the potential impacts associated with the reserve and proposed management plan would be largely identical to those described for the yacht club, above. The expenditures associated with meeting the requirements of the management plan would produce adverse impacts to Quartermaster Marina, although its clients may experience positive impacts associated with maintaining and enhancing the area's aquatic environment. The DNR would work collaboratively with the marina owners to develop a plan for reducing existing impacts and to determine additional ways that the marina could serve the objectives of the reserve.

King County Parks – Dockton Area Pier and Boat Dock: Reserve designation and management plan implementation could produce both positive and negative impacts to King County in relation to the pier and boat dock at Dockton Park. King County has no immediate plans to modify the existing structure and the current use authorization is valid until 2012. Therefore, the proposed management plan may not result in impacts to the Dockton facility until King County applies for reauthorization of their use. At such time, King County may experience minor negative financial impacts, similar to those described above for the yacht club, associated with ensuring that operations and structures comply with the provisions of the management plan, which are geared toward reducing impacts and enhancing aquatic habitat. The DNR would work collaboratively with King County to develop a plan for reducing existing impacts and to determine additional ways the Dockton Park facility could serve the objectives of the reserve. Users of Dockton Marina may experience positive indirect impacts associated with maintaining and enhancing the area's aquatic environment.

Glacier Northwest – Maury Island Gravel Barge Loading Facility: Reserve designation and the proposed management plan has the potential to adversely affect Glacier Northwest. In order to replace the existing pier and dock structure at the site, Glacier Northwest would have to first demonstrate that such activities could be conducted without resulting in net loss of habitats and species identified for conservation in the proposed management plan. This could require that Glacier first conduct restoration or enhancement activities in the area to improve existing conditions prior to conducting construction activities that could adversely affect current conditions. If such measures were required, this could lead to minor delays in the construction of the barge loading facility, which would adversely impact Glacier's use of the area and could result in a financial burden associated with expenditures for restoration or enhancement activities and delays.

Furthermore, Glacier would need to construct the pier and dock facility in a manner consistent with the specific management provisions for the facility described in the management plan. As Glacier would also need to secure Corps and King County permits for the proposed expansion, many of the structural requirements contained in

the proposed management plan would already be met through the regulatory permitting process.

Glacier would also need to demonstrate that their operations (i.e., barge loading) would not result in net loss of the habitat and species identified in the proposed management plan. Of particular concern would be issues associated with noise, light, prop wash, gravel spills, nearshore drift interruption, and other related operational concerns. Complying with these requirements could result in design or operational modifications that may be less cost effective than other operational methodologies, which could produce an adverse impact to Glacier Northwest. Many of these concerns may have already been addressed in Glacier's most recent design and operations proposal for the Maury Island gravel mine and barge loading facility.

The management plan states that activities occurring at the Maury Island site must primarily serve the objectives of the reserve. While the fundamental objective of Glacier Northwest's operations on state-owned aquatic lands would be to transport gravel, measures could be implemented to ensure that a use authorization for Glacier served the objectives of the reserve. The DNR would work collaboratively with Glacier Northwest to identify such measures. However, such provisions of a use authorization for Glacier Northwest would produce a negative direct impact due to the financial burden associated with implementing activities to serve the objectives of the reserve.

The DNR recognizes that the current Glacier Northwest proposal already includes a number of components that would benefit the reserve, such as maintaining a 200-foot shoreline buffer between the mine and the shoreline. This buffer would ensure that natural erosion and sediment deposition processes in the area were maintained, which would benefit the drift cell along the eastern shoreline of Maury Island. Existence of the gravel mine also ensures for at least the near future that other development, which could modify the shoreline and disrupt natural processes, would not occur at the site. These and possibly other potential reserve-wide components of Glacier Northwest's proposal, could contribute to the goals and objectives of the aquatic reserve.

Puget Sound Energy – Utility Rights-of-Way: As the Puget Sound Energy rights-of-way in the area are valid in perpetuity, the proposed management plan would likely have no impact on these existing use authorizations. Further, under the Preferred Alternative, portions of the Puget Sound Energy rights-of-way would no longer be within the reserve boundary and would, therefore, not be subject to the provisions of the management plan. Land managers at DNR may work with Puget Sound Energy to reduce any potential adverse impacts associated with maintenance of the submarine cables that would remain within the proposed reserve boundary, although the need for such actions is uncertain at this time.

Comcast – Utility Right-of-Way: The Comcast submarine cable project could be adversely affected by the Preferred Alterative. A portion of the right-of-way for the project would still pass through the proposed reserve boundary, but less of the right-

of-way would be within the reserve compared to the No Action Alternative. In order to avoid species and habitat impacts related to construction of the portions that pass through the reserve boundary, Comcast may be required to utilize more expensive design and construction strategies and would also need to implement actions to primarily serve the objectives of the reserve.

Future Use Proposals: Any new use proposed in the future would be subject to the proposed management plan provisions related to the type of use proposed (i.e., marina, fish pen, etc.). This could result in adverse impacts because some potential uses would not be permissible within the Maury Island site under the Preferred Alternative (Table 5). In addition, there may be additional costs for new uses resulting from: 1) ensuring no net loss of habitats and species identified for conservation in the proposed management plan, and 2) implementing actions to primarily serve the objectives of the reserve.

Historical and Cultural Resources: The proposed management plan would have no impact on the historic and cultural resources identified in the vicinity of the Maury Island site, as these sites are not within the reserve and DNR would not authorize uses that would adversely impact these resources. In addition, DNR would consult with the Puyallup Tribes and other applicable entities to ensure that management of the Maury Island site would adequately protect historic and cultural resources.

Consistency with Other Pertinent Regulations: As discussed above, reserve designation and the proposed management plan would be consistent with the King County Shoreline Master Program and King County Comprehensive Plan and DNR would collaborate with King County to ensure continued consistency.

The Preferred Alternative's proposed management plan would also be consistent with Ecology's regulatory authority relating to the NPDES program, 401 certifications, and Coastal Zone Management certification. The management plan proposes research and monitoring that would likely include water quality and sediment sampling. These efforts could assist Ecology in the administration of their regulatory mandates. However, DNR would need to consult with Ecology prior to undertaking research and monitoring projects to ensure that efforts are not duplicative and utilize approved methodologies.

The proposed management plan is also consistent with the objectives of HPA permits administered by WDFW. The management plan includes provisions related to protection of fisheries resources (e.g., salmonids and forage fish) and fish habitat (e.g., eelgrass), which is the primary purpose of HPA permits. DNR could, however, impose requirements in addition to those in an HPA permit to protect the state-owned aquatic lands for which DNR is steward. These additional measures, if required by DNR staff, would not impact WDFW's authority or ability to implement the HPA program.

The proposed management plan would also be consistent with the Corps' issuance of Section 404 and Section 10 permits. If deemed necessary, DNR could require additional conditions for uses within the reserve, but this would not impact the Corps' authority or ability to issue Section 404 or 10 permits.

Implementation of the proposed management plan would be consistent with administration of ESA by NOAA-Fisheries and USFWS. The management plan would conserve, protect, and enhance aquatic environmental resources, which could ultimately benefit listed species.

4.7.2.2 Alternative 2 (Repeal the Reserve)

The Repeal the Reserve Alternative would likely have no or negligible impacts on local planning, shoreline modification, existing land uses, existing and proposed use authorizations

Local Planning: Repealing the aquatic reserve designation for the Maury Island site would not have a direct impact on upland land uses, which are primarily directed by the King County Comprehensive Plan and Shoreline Master Program. Thus, upland land uses would continue as directed by King County.

Without the reserve designation, DNR would be less likely to actively engage King County to collaborate on land management issues related to the Maury Island site. Nothing would preclude establishing an interagency working relationship, but there would be no DNR guidance dictating that staff should pursue such efforts, lessening the likelihood. Without the reserve designation, DNR use authorizations would be negotiated under existing policy, which would not conflict with King County's implementation of their land use plans or policies.

Without the reserve designation DNR would also be less likely to work with King County to help avoid impacts on the Maury Island site that could result from future development.

Shoreline Modification: Repealing the reserve designation would have uncertain impacts on shoreline modification in the area. Without the reserve, it is unlikely that DNR would actively pursue a relationship with King County to aid in reducing shoreline modification, which may indirectly contribute to maintenance of existing armoring levels and possible increases in shoreline modification.

It is also unlikely that DNR would engage local landowners to reduce impacts from shoreline modification without a reserve designation in place. Since no proactive measures on behalf of DNR would be taken, there would be no direct benefits to shoreline modifications in the area.

Existing Land Uses: Repealing the reserve designation would not impact the majority of existing upland uses, which are residential and agricultural in nature. King

County would likely continue to administer their zoning and regulatory authority in a manner similar to existing conditions.

The absence of a reserve in the area would also have no impact on recreational uses. Activities such as boating, water-skiing, kayaking, fishing, and sailing would continue as they do currently. Similarly, recreational shellfish harvesting and beach walking on privately owned tidelands would continue at existing levels. The DNR would maintain the authority to manage uses of state-owned aquatic lands in accordance with existing guidance and policies.

The DNR would likely not inventory recreational docks and mooring buoys in the absence of aquatic reserve designation; therefore, there would be no affect on recreational docks and mooring buoys in the area.

Existing and Proposed DNR Use Authorizations:
Quartermaster Yacht Club: With the reserve designation repealed, the lease for the yacht club, which has been in holdover status, would be negotiated based upon existing DNR guidance and policies. DNR would rely to some extent on the regulatory agencies (i.e., WDFW, King County, and Corps) to determine the structural and operational requirements for the marina. However, DNR would maintain the authority to require additional measures if deemed necessary to ensure environmental protection. Such additional measures would not likely cause a significant impact to the Quartermaster Yacht Club.

Quartermaster Harbor Marina: A use authorization for the expansion of Quartermaster Marina would also be negotiated under current DNR guidance, with similar impacts to those described above for the yacht club.

King County Parks – Dockton Park Pier and Boat Dock: The lease for the King County facility does not expire until 2012, so no additional measures would be required of King County until that time. When negotiating a new lease for the site, the potential impacts would be similar to those described above for the yacht club.

Glacier Northwest – Gravel Barge Loading Facility: Without the reserve designation, negotiation for a lease at the site would be conducted under current DNR guidance and policies. DNR would rely to some extent on the regulatory agencies (i.e., WDFW, King County, and Corps) to determine the structural and operational requirements. However, DNR would maintain the authority to require additional measures if deemed necessary to ensure environmental protection. The likelihood that additional measures would be required without a specific management plan in place for the site is uncertain, but would not likely lead to significant impacts on Glacier Northwest.

Puget Sound Energy – Utility Rights-of-Way: Without the reserve designation, the Puget Sound use authorizations, which are valid in perpetuity, would not likely be impacted.

Comcast – Utility Right-of-Way: Rescinding the reserve designation would not likely impact the Comcast submarine cable proposal. A use authorization for this proposal would be negotiated in accordance with current DNR guidance and policies.

Future Use Proposals: Any new use proposed in the future would be subject to existing DNR policies for uses of state-owned aquatic lands. There would be no outright prohibitions of uses in the area. However, DNR would retain the authority to deny proposals considered inappropriate or require mitigation and enhancement provisions deemed necessary to adequately protect aquatic resources. Thus, this alternative would not be expected to produce significant adverse effects on future use proposals.

Historical and Cultural Resources: Rescinding the reserve designation would not impact historic and cultural resources in the vicinity. The DNR would continue to manage activities adjacent to such resources in accordance with existing guidance and policies.

Consistency with Other Pertinent Regulations: Rescinding the reserve designation would not conflict with other regulations germane to the Maury Island site. Land managers at DNR would continue to negotiate use authorizations with the knowledge that use proponents have a regulatory obligation to obtain the necessary permits and approvals from regulatory agencies to ensure that projects are conducted lawfully.

4.7.2.3 Alternative 3 (No Action)

Alternative 3 would have a low probability of causing positive impacts for local planning and shoreline modification. There would be a moderate probability of adverse effects on existing and proposed DNR use authorizations associated with the costs of meeting reserve objectives.

Local Planning: Maintaining the reserve designation without implementing a site-specific management plan would not have a direct impact on upland uses, which are primarily directed by the King County Comprehensive Plan and Shoreline Master Program, as DNR does not have authority over upland uses. As discussed above for the Preferred Alternative, King County supports the reserve designation and has expressed the desire to collaborate with DNR in the development of a management plan for the Maury Island site. Under this alternative, no management plan would be drafted, which would not be consistent with the position expressed by King County regarding the reserve.

The programmatic FEIS states that DNR must work with local agencies, such as King County, to minimize off-site impacts, although there is no specific guidance relating to the types of issues that should be addressed through cooperation with King County. Under the No Action Alternative it is uncertain whether DNR would specifically collaborate with King County in regards to land management strategies and to what extent interagency cooperation would be made a priority. Thus, the interagency-

cooperation dictated by the No Action Alternative would have a low probability of resulting in beneficial impacts on land management strategies compared to the Preferred Alternative, which explicitly outlines the types of issues that should be addressed through the development of interagency relationships.

Shoreline Modification: Maintaining the reserve designation under the original boundary but not creating a site-specific management plan would have uncertain impacts on shoreline modification in the area. The programmatic FEIS states that DNR must work with local jurisdictions, regulatory agencies, and adjoining landowners to minimize off-site impacts. Yet there is no specific guidance directing DNR staff to pursue a relationship with King County to aid in reducing shoreline modification, as there is under the Preferred Alternative. Given this lack of guidance, there is a lower probability under the No Action Alternative compared to the Preferred Alternative that DNR would make interagency collaboration related to shoreline modification a priority.

It is also likely that DNR would not engage local landowners in efforts to reduce impacts from shoreline modification or secure funding for such activities without a site-specific management plan directing these efforts.

Existing Land Uses: Maintaining the original reserve designation without creating a management plan would not impact the majority of existing upland uses, which are residential and agricultural in nature. However, the programmatic FEIS does state that DNR "must work with local jurisdictions… to minimize off-site impacts" (DNR 2002). Yet without more specific guidance pertaining to this type of inter-agency coordination, it is uncertain to what extent such activities would be undertaken and how successful they may be. In general, King County would continue to administer their zoning and regulatory authority in a similar manner to existing conditions.

Maintaining the reserve designation without a management plan would also not impact recreational uses, such as boating, water skiing, kayaking, fishing, shellfish harvesting, and sailing. Transitory recreational activities occurring on state-owned aquatic lands would also continue under existing conditions, as no provisions in the programmatic FEIS suggest altering management of recreational uses.

Without a management plan for the reserve, the DNR would likely not attempt to inventory recreational docks and mooring buoys at the Maury Island site, as there would be no specific guidance directing this action. Thus, there would likely be no effects to existing recreational docks and mooring buoys caused by the No Action Alternative.

However, applications for new use authorizations for mooring buoys would not be granted if the buoy would alter, remove, and/or otherwise change any existing environmental or cultural characteristic of the reserve. This would have a low probability of producing beneficial and adverse impacts on boating in the area. It could produce a negative impact to potential applicants that wish to secure a mooring

buoy in the area, as these individuals may be forced to seek alternatives for mooring their vessels. Yet, it could also produce beneficial impacts to boaters in the area, as additional mooring buoys, especially in inner Quartermaster Harbor, produce potential navigation obstacles that would be controlled under the No Action Alternative.

Existing and Proposed DNR Use Authorizations:
Quartermaster Yacht Club: In order to authorize a proposal for expansion of the existing facility, the yacht club would need to demonstrate that activities conducted would not further degrade environmental resources and would primarily serve the objectives of the reserve (DNR 2002). Without a site-specific management plan, there would be a reduced level of certainty regarding how DNR would interpret these directives. If the use were found by the DNR to be incompatible with the reserve designation, then the existing lease would be allowed to expire and would not be renewed. In general, the DNR would likely negotiate the lease for the yacht club, which has been in holdover status, based upon current DNR guidance and policies. Land managers at DNR would likely rely on the regulatory agencies (i.e., WDFW, King County, and Corps) to some extent as far as structural and operational requirements for the marina. However, the DNR would maintain the authority to require additional measures if deemed necessary to ensure environmental protection and primarily serve the objectives of the reserve. It is likely that reserve status, without a management plan, would mean that the DNR would require additional measures on the marina or possibly not reauthorize the use. Therefore, there would be a moderate probability of adverse impacts on the yacht club associated with the costs of meeting reserve objectives and potentially not having their use reauthorized.

Quartermaster Harbor Marina: A use authorization for the expansion of Quartermaster Marina would also likely be negotiated under current DNR guidance, with similar impacts to those described above for the yacht club.

King County Parks – Dockton Park Pier and Boat Dock: The use authorization for the King County facility at Dockton does not expire until 2012, so no additional measures would likely be required of King County until that time. When negotiating a new lease for the site, the potential impacts would be similar to those described above for the yacht club.

Glacier Northwest – Gravel Barge Loading Facility: The reserve designation without a management plan would have a moderate probability of producing negative impacts on the Maury Island gravel mine. Glacier Northwest would have to demonstrate that the proposal would avoid, minimize, and compensate for all environmental impacts that may occur and would primarily serve the objectives of the reserve (DNR 2002). Without additional site-specific guidance, it is uncertain how DNR would interpret and implement these directives. If DNR found that the proposed use was incompatible with the reserve, then no authorization would be issued. In general, in negotiating the lease DNR would rely to some extent on the regulatory agencies (i.e., WDFW, King County, Ecology, and Corps) as far as structural and operational

requirements for the facility. The DNR would maintain the authority to require additional measures for the protection of environmental resources and to ensure that activities primarily serve the objectives of the reserve.

Puget Sound Energy – Utility Rights-of-Way: Under the No Action Alternative it is unlikely that DNR would suggest modifications to the submarine cables in the area for which the current use authorizations are valid in perpetuity. Thus, there would likely be no impact. However, if maintenance or upgrades to the cables were necessary, Puget Sound Energy would have to demonstrate that such activities would avoid, minimize, and compensate for all potential environmental impacts.

Comcast – Utility Right-of-Way: Under the No Action Alternative, the proposed Comcast submarine cable would still be within the boundary of the aquatic reserve. Thus, Comcast would need to demonstrate that their activity could be conducted without further impact on aquatic resources and in a manner that primarily serves the objectives of the reserve. Without further guidance in the form of a site-specific management plan, the programmatic FEIS provides little certainty to Comcast regarding how DNR may handle the use authorization negotiation. For the most part, use authorizations would be negotiated under the general management actions detailed in the programmatic FEIS. As such, it is likely that DNR would propose measures in addition to permit and approval requirements of the regulatory agencies (i.e., WDFW, King County, Ecology, and Corps) or may not authorize the use. Thus, there would be a moderate probability of negative impacts to the Comcast right-of-way.

Future Use Proposals: Any new use proposed in the future would be required to demonstrate that it could be conducted without further impact on aquatic resources and in a manner that primarily serves the objectives of the reserve. These provisions would likely result in adverse impacts to future use proposals as a result of 1) the cost of ensuring no further impact on aquatic resources and 2) primarily serving the objectives of the reserve.

Historical and Cultural Resources: Maintaining the original reserve designation without a management plan would not impact historic and cultural resources in the vicinity, as documented resources are located outside of the reserve boundary. The programmatic FEIS states, "no future use authorizations will be granted that alter, remove, and/or otherwise change any existing environmental or cultural characteristics…" (DNR 2002). Therefore, under the No Action Alternative, DNR land managers would critically review use authorization applications to ensure that actions conducted within the reserve would not impact cultural resources.

In addition, the programmatic FEIS states that DNR land managers would coordinate with Tribal interests when reviewing use authorizations. Thus, DNR would consult with the Puyallup Tribes and other applicable entities to ensure that use authorization adequately consider impacts to historic and cultural resources.

Consistency with Other Pertinent Regulations: The No Action Alternative would not conflict with other regulations germane to the Maury Island site. Land managers at DNR would continue to negotiate use authorizations with the knowledge that use proponents have a regulatory obligation to acquire the necessary permits and approvals from regulatory agencies to ensure that projects are conducted lawfully.

4.8 Transportation

Aspects of transportation that apply to the Maury Island site are predominantly related to waterborne transportation, although there are some roadways and bridges on uplands adjacent to the site.

4.8.1 Affected Environment

There are no commercial ferry operations within the Maury Island site, nor are there currently commercial operations in the area predominantly geared toward the transportation of goods. If the gravel barge loading facility along the eastern shoreline of Maury Island was made operable, then up to four gravel barges per day could use waters within the Maury Island site for transportation of goods. The site also provides recreational waterborne transportation to residents of Maury and Vashon islands, as well as visitors to the area.

The United States Constitution gives the federal government "navigational servitude." In doing so, the Constitution protects the use of navigable waters and aquatic lands for navigation and commerce. The DNR does not have the authority to prevent vessels from transiting any navigable waters of the state.

4.8.2 Impact Analysis

4.8.2.1 Alternative 1 (Preferred Alternative)

The Preferred Alternative would have a low probability of causing direct negative impacts to waterborne transportation facilities at discrete locations throughout the site.

The Maury Island Reserve designation and proposed management plan could reduce the areas considered suitable for new bridges or roadways. There are currently no proposals for roadway projects that would traverse or encroach upon state-owned aquatic lands, and since the site is located around islands, it is unlikely that additional applications for use authorizations would occur. Therefore, the potential impact on potential roadway expansion projects would likely be undetectable.

Reserve designation and the proposed management plan could also limit the potential locations for waterborne transportation facilities, such as large docks or wharves. The Glacier Northwest facility is currently the only proposed use within the Maury Island site related to waterborne transportation and the potential effects on that operation are discussed in Section 4.7.2.1.

It is important to reiterate that DNR does not have the authority to limit the use of private commercial or recreational boats in state waters. Therefore, reserve

designation and the implementation of the proposed management plan would have no impact on the use of vessels within the Maury Island site.

4.8.2.2 Alternative 2 (Repeal the Reserve)

Alternative 2 would have no impacts on waterborne transportation facilities at or near the site.

Repealing the reserve designation at the Maury Island site would likely have no impact on transportation systems in the area. Proposals for transportation systems would be permissible throughout the Maury Island site, although DNR would have the authority to require mitigation or enhancement provisions deemed necessary to adequately protect the aquatic resources in the area.

4.8.2.3 Alternative 3 (No Action)

Alternative 3 would have a moderate probability of causing direct negative impacts to transportation system and facilities at discrete locations throughout the site.

Transportation impacts associated with the No Action Alternative would be uncertain. There would be no site-specific management provisions to direct authorizations related to transportation. However the rather strict directives of the programmatic FEIS would not permit new roadway transportation projects within the aquatic reserve if they would alter, remove, and/or otherwise change any existing environmental or cultural resources. This could produce a moderate impact on roadway transportation projects designed to cross or encroach upon the aquatic reserve.

Under No Action, new waterborne transportation facilities would also not be permitted in the reserve if they would result in environmental or cultural resource degradation. This would have a moderate probability of producing adverse impacts on waterborne transportation projects and could limit the accessibility of areas within the reserve by boats that require structural moorage facilities.

4.9 Public Services and Utilities

The SEPA definition of public services identifies a variety of components including: fire departments, police departments, schools, parks or other recreational facilities, maintenance, communications facilities, water/storm water systems, sewer/solid waste facilities, and any other governmental services or utilities. Management of the Maury Island site does not have the potential to impact services such as fire and police departments or schools, but it could impact recreational facilities, communications, and discharge systems.

4.9.1 Affected Environment

King County owns and operates a public park near Dockton. The park includes a public pier and 58-slip boat dock (see Section 4.7.2.1.), a boat launch, two restrooms, showers, picnic and barbecue areas, a playground, two parking lots, and beach access. The park is comprised of 20.52 acres of uplands, and an additional 0.81 acres of state-owned aquatic lands upon which the pier and boat dock are constructed. Only the state-owned aquatic

lands would be directly affected by the DNR management strategies evaluated in this SEIS.

King County also operates the 320-acre Maury Island Marine Park along the eastern shore of Maury Island. The park is located at the site of an old gravel pit. Facilities include a fishing pier, restroom, lookout tower, and parking lot. The pier was originally used for loading gravel onto barges when the upland site was operated as a gravel mine. The DNR management strategies for the Maury Island site would have the potential to impact the existing pier, as it may be partially constructed on state-owned aquatic lands without a use authorization.

The Vashon Park District operates the Burton Acres Park and Point Robinson Park, which are adjacent to the Maury Island site. The 68-acre Burton Acres Park includes a boat launch, restroom, hiking trails, beach access, and a parking lot. The 10-acre Point Robinson Park includes picnic facilities, trails, and beach access. The U.S. Coast Guard operates the Point Robinson Lighthouse facility.

Along the northeast shoreline of Maury Island, there are several utility easements that pass through the study area (Appendix J). These easements are held by Puget Sound Energy and are for the purposes of submarine cable that provides power, natural gas, and telecommunications to the island. Authorizations for the easements extend in perpetuity. In addition, Comcast is proposing the construction of a submarine fiber optic cable along the northern shoreline of Maury Island, as described in Section 4.7.2.1.

There are likely stormwater and other water discharge systems at the Maury Island site, although DNR does not have a full inventory of these facilities at this time.

4.9.2 Impact Analysis

4.9.2.1 Alternative 1 (Preferred Alternative)

The Preferred Alternative would have a moderate probability of causing direct negative impacts to public services and utilities at discrete locations throughout the site, but would also have a moderate probability of indirect benefits to public services through improved environmental conditions within the reserve.

The Preferred Alternative would produce both minor adverse and beneficial impacts on parks at the Maury Island site. The Dockton Park currently has a use authorization with DNR for its public dock facility. Under the Preferred Alternative, King County would likely be required to make changes to this dock over time to reduce potential impacts on aquatic vegetation and fish in the area. The current dock is constructed of closely spaced wood planks suspended by floats and wooden pilings. To continue using state-owned aquatic lands at the Dockton site, DNR would likely require that King County make modifications to the existing structure to reduce overwater shading and replace treated pilings that could impact water quality, which would have a moderate probability of producing adverse impacts associated with the costs of such changes. These modifications may be in excess of the requirements of other regulatory agencies (e.g., King County, WDFW, and Corps).

The management plan also states that activities cannot further degrade the existing conditions within the reserve. Therefore, if King County desired to modify the existing dock and pier structure in a manner that would impact the resources identified for protection under the management plan, then they would first have to demonstrate enhancement of the resources to be impacted prior to any activities that may disturb those resources. This could adversely affect park operations by delaying modifications that may be necessary to meet increasing demand for public boat moorage within Quartermaster Harbor.

Dockton Park would also experience beneficial impacts from the reserve designation and management plan. The provisions of the management plan to protect the natural resources of Quartermaster Harbor would help to ensure sustainable fish populations, clean water, and in general, a healthy aquatic ecosystem, which would enrich the recreational experience for users of Dockton Park.

King County's Maury Island Marine Park would also benefit from reserve designation. The purpose of this park is to provide a location for the public to experience the natural character of Maury Island and the surrounding waters. Reserve designation would help to ensure the preservation of the aquatic natural resources in the area, which is consistent with the purposes of the marine park. The DNR may require that King County acquire a use authorization for the pier structure and make modifications to the existing structure to minimize potential impacts from shading and treated wood pilings. The Marine Park would likely primarily support the objective of the reserve since it provides outdoor public use opportunities, which would likely benefit the reserve at-large.

The reserve designation and proposed management plan would not have a direct impact on Burton Acres Park or Point Robinson Park, as neither of these facilities includes structures on state-owned aquatic lands. Yet, both of these facilities may experience beneficial impacts from the reserve in the form of preservation of the quality of the aquatic resources in the area, which may enhance the recreational experience of park users.

The Preferred Alternative would have a moderate probability of producing negative impacts on future public services and utilities. Reserve designation would likely decrease the areas on state-owned aquatic lands available for new communications systems, water and waste disposal, and other services and utilities or at least require additional provisions for construction within the reserve. Existing utility easements along the northeast shoreline of Maury Island would not be affected since they have perpetual easements.

Under the Preferred Alternative, DNR would work to inventory existing outfalls that discharge onto state-owned aquatic lands. These outfalls may be physically located within the Maury Island site or located adjacent to the Maury Island site on private or public lands. Following the inventory, DNR would work with outfall owners to

ensure the outfalls are authorized (if within the reserve) and to minimize and avoid potential adverse impacts on aquatic resources. Such measures may produce an adverse impact to outfall owners in the form of additional costs to ensure aquatic resource protection. However, for structures not located within the reserve, efforts to decrease potential impacts from the outfalls would be voluntary.

4.9.2.2 Alternative 2 (Repeal the Reserve)

Alternative 2 would likely produce no significant impacts on public services or utilities at or near the site.

Repealing the reserve designation would likely have no impacts on parks, utilities, and other public services. For example, the current use authorization for the Dockton pier and boat dock expires in 2012. At that time, without a reserve designation it would be under the discretion of DNR staff whether or not to require that King County implement additional aquatic resource protection measures (i.e., reduce shading and remove treated wood piles) that would be explicitly required under the Preferred Alternative. Thus, the financial commitments that may be experienced under the Preferred Alternative may not occur without reserve designation in the area. King County, however, would be afforded no certainty regarding the types of provisions that may or may not be required for use authorizations, as there would be no site-specific management plan for the area. This could result in unanticipated costs for King County associated with the facility.

Furthermore, if King County were to propose any modifications or expansions to the existing dock and pier structure they would need to secure permits from the Corps. The Corps already requires most of the types of modifications to overwater structures (i.e., reduce shading, etc.) that are included in the proposed management plan. Therefore, even without reserve designation, King County may need to implement such aquatic resource protection measures.

The same types of potential impacts would exist for authorization or modification of the existing pier at the Maury Island Marine Park. Thus, without a site-specific management plan, there would be less certainty regarding what measures may or may not be required of King County to secure use authorizations in the area.

Rescinding the reserve designation would not directly impact Burton Acres Park and Point Robinson Park. However, these parks would not experience the potential beneficial impacts from the preservation and enhancement of aquatic resources at the Maury Island site associated with the Preferred Alternative.

Alternative 2 would not impact the existing Puget Sound Energy utility easements along the northeastern shoreline of Maury Island. These easements are valid in perpetuity and would continue without modifications.

Other utilities, such as Comcast, that may utilize the Maury Island site would not likely be impacted under Alternative 2, as use authorizations would be negotiated in

the same manner as for all other non-reserve lands. There would likely be fewer restrictions on the locations that utility facilities could be constructed on state-owned aquatic lands. Yet, DNR would maintain the authority to require environmental protection measures for use authorizations as deemed appropriate. Therefore, there would be less certainty for applicants pertaining to the types of requirements that would be part of a use authorization at the Maury Island site.

Outfall operators would not likely be impacted under Alternative 2. Existing discharges would likely continue operations without additional review, authorization, and/or assistance by DNR. Without reserve designation at the Maury Island site, the DNR would likely not inventory discharges in the area or work directly to ensure water quality and sediment protection on state-owned aquatic lands due to resource and staffing constraints.

4.9.2.3 Alternative 3 (No Action)

Alternative 3 would have a moderate probability of causing direct negative impacts to public services and utilities at discrete locations throughout the site. The types of beneficial and adverse impacts of the No Action Alternative on parks, utilities, and other public services would be similar to those described for Alternative 1.

The area would still be considered an environmental aquatic reserve, but there would be no site-specific management provisions for the reserve; therefore, the DNR staff would apply management guidelines from the programmatic FEIS and relevant RCWs and WACs. The general negative effects on public services would likely be more than Alternative 1 and Alternative 2, as the restriction under the programmatic FEIS are rather strict.

Upon expiration of the use authorization for Dockton Park, King County would likely be required to implement some aquatic resource protection measures, as described for Alternative 1. In addition, if expansion or modification of the dock and pier structure were proposed, King County would need permits from the Corps which could result in the same types of impact minimization measures as those proposed in the Preferred Alternative's management plan. There would be similar impacts regarding authorization for the existing pier at the Maury Island Marine Park.

The No Action Alternative would likely indirectly impact Burton Acres Park and Point Robinson Park, as the recreation areas may experience fewer beneficial impacts from improved aquatic resource conditions in the area in comparison to the Preferred Alternative.

Under the No Action Alternative it is likely that DNR would allow the utility easements along the northeastern shoreline of Maury Island to continue in perpetuity without additional modifications, unless specific environmental concerns arose.

Comcast and other potential public service purveyors would also face a high level of scrutiny associated with DNR management of the Maury Island site. These entities

would likely experience additional restrictions on the locations and construction strategies for proposed uses of state-owned aquatic lands for the purposes of utilities and public services.

The impacts to owners and operators of outfalls that apply for use authorizations within the Maury Island site would likely be high due to standards established in the programmatic FEIS. The DNR land managers, however, would not have explicit directives to inventory and proactively manage outfalls that currently exist within the Maury Island site, which would make it less likely that such activities would occur.

5.0 Cumulative Effects Analysis

In the analysis of impacts in an EIS prepared in accordance with SEPA, the lead agency must consider direct, indirect, and cumulative impacts (WAC 197-11-792(2)(i). Yet, the WACs do not provide a definition of what comprises cumulative impacts. However, the term has been defined in a number of other arenas. In general, cumulative impacts on the environment are those that result from the incremental impact of a specific action when added to other past, present, and future actions. Cumulative impacts can result from minor impacts from a specific action that when considered in the spatial and temporal context of other activities in the area can collectively result in significant impacts. For example, the clearing of a single tree in a riparian area would likely have immeasurable impacts at the watershed scale, although the incremental impact of clearing many trees in a given area over time can produce substantial impacts to a watershed.

For a non-project action such as the proposed management framework for the Maury Island site, it can be difficult to effectively assess cumulative impacts, as there is not a particular site-specific activity being proposed. Therefore, the following evaluation of cumulative impacts focuses on other resource management plans and policies within the area and how the proposed action would likely interact with these to produce potential beneficial or adverse cumulative impacts. The spatial scope of the following discussion considers potential cumulative impacts in the spatial context of the Puget Sound region with a temporal scope of 90 years, the term of the proposed reserve designation.

There is a clear trend in western Washington, particularly in the Puget Sound region, of increasing development and associated habitat loss. Additional residential and commercial development is planned throughout much of the local area, as well as the central Puget Sound region. Within this context of increasing development, either Alternatives 1 or 3 would preserve habitat as an Aquatic Reserve. Conservation and restoration of lands through management actions identified in Alternative 1 would maintain or increase the carrying capacity of Quartermaster Harbor and surrounding environs for fish and wildlife. Additionally, Alternatives 1 and 3 would complement other regional habitat acquisition or protection programs under consideration by local, state, federal, Tribal, and non-governmental agencies resulting in positive cumulative effects to fish and wildlife.

Cumulative effects involving the outreach and educational programs associated with Alternative 1 would be an overall improvement in the quality of environmental education and wildlife-dependent recreation opportunities in central Puget Sound.

5.1 Earth

The proposed action would produce beneficial cumulative impacts on geology and soils when considered in the context of other land management planning activities for the area. The King County Comprehensive Plan states that development within the county shall protect important ecological resources and also encourages the restoration of critical areas. Such ecological functions that King County attempts to protect include riparian function and natural erosion processes along water bodies. The proposed management plan also encourages bank protection and would prohibit activities that would adversely impact drift cells within the site. The potential incremental benefits of King County's land use planning

and the proposed Maury Island management plan when considered together could produce a cumulative beneficial impact for natural erosion processes in the immediate area and the central Puget Sound as a whole.

Alternative 2 would have a low probability of negligibly contributing to adverse cumulative effects on geology and soils. Under the Repeal the Reserve Alternative, DNR would issue use authorizations at the Maury Island site in the same manner as for the rest of the 2.4 million acres of state-owned aquatic lands that the agency manages. Without the protective guidance included in the proposed management plan, activities that may be authorized within the Maury Island site may be conducted in a manner that could contribute to shoreline modification and/or disruption of nearshore sediment transport. When considered with other development projects throughout the Puget Sound, such activities could produce a minor adverse cumulative impact on geology and soils. However, due to the small size of the Maury Island site in comparison to the Puget Sound as a whole, cumulative impacts associated with Alternative 2 would likely be immeasurable.

The potential cumulative impacts that may occur under Alternative 3 would be similar to those described above for the Preferred Alternative. However, without a management plan that defines a systemic and standardized method for accounting for impacts of activities occurring at the Maury Island site, the likelihood of realizing the potential beneficial cumulative impacts on geology and soils would be reduced under Alternative 3.

5.2 Air

Although DNR does not have jurisdiction over air quality, activities conducted under authorizations for the use of state-owned aquatic lands could have impacts on air quality. Under the Preferred Alternative the restrictions placed on uses and BMP requirements could produce a localized benefit to air quality. Benefits would accrue as a result of fewer commercial vessel visits to the reserve area and a decreased likelihood that water-dependent industrial enterprises would locate adjacent to the reserve. This indirect effect of the reserve when considered in context with regional efforts to improve air quality in the metropolitan areas of Puget Sound could produce a minor beneficial cumulative impact.

Conversely, under Alternative 2, there would be less stringent requirements for uses occurring at the Maury Island site. This would produce a low probability of negligible adverse cumulative effects associated with air quality if projects authorized by DNR at the site increased air pollution, which would be contrary to regional efforts to improve air quality in the Puget Sound. However, as the Maury Island site is small in comparison to the Puget Sound as a whole, such potential cumulative impacts would likely be immeasurable.

The potential cumulative impacts that may occur under Alternative 3 would be similar to those described above for the Preferred Alternative. However, without a management plan that defines a systemic and standardized method for accounting for impacts of activities occurring at the Maury Island site, the likelihood of realizing the potential beneficial cumulative impacts on air quality would be reduced under Alternative 3.

5.3 Water Resources

Under the Preferred Alternative, no use authorizations or re-authorizations would be granted if the activity would result in adverse impacts on water quality in the area. Proponents of uses of state-owned aquatic lands would need to demonstrate that they could implement adequate design components and BMPs to avoid adverse impacts on water quality in the area. In addition, DNR would collaborate with King County to find ways in which existing septic systems, stormwater runoff, and other upland land uses could be structured to reduce potential water quality impacts at the Maury Island site. These activities when considered in the context of efforts by King County, the Puget Sound Action Team, Washington Department of Ecology, and other entities to improve the water quality of the Puget Sound could produce a minor cumulative beneficial impact.

Under Alternative 2, there would be no guidance specifically directing DNR land managers to work to protect water quality and quantity at the Maury Island site. This could lead to minor adverse impacts on water resources in the area, which could negligibly contribute to adverse cumulative impacts on water quality in the Puget Sound as a whole, as adverse localized impacts would be contrary to region-wide water quality planning.

The potential cumulative impacts that may occur under Alternative 3 would be similar to those described above for the Preferred Alternative. However, without a management plan that defines a systemic and standardized method for accounting for impacts of activities occurring at the Maury Island site, the likelihood of realizing the potential beneficial cumulative impacts on water resources would be reduced under Alternative 3.

5.4 Plant and Animal Resources

The Preferred Alternative stresses the preservation of aquatic vegetation at the Maury Island site and would not permit any authorization or re-authorization that would impact aquatic vegetation in the area. This activity would indirectly benefit the herring population in the area, which depends upon this habitat for spawning and rearing. This localized beneficial impact to aquatic vegetation and herring when considered in conjunction with efforts by WDFW through the HPA program to conserve aquatic vegetation throughout the state for the benefit of forage fish and other aquatic species would produce a minor cumulative benefit to aquatic vegetation and forage fish in the Puget Sound as a whole.

Benefits to the herring population in the area would also indirectly benefit salmonid populations in the vicinity as herring and other forage fish are a major diet component for salmonids. In addition, maintaining salmonid migration corridors in the area, protecting water quality, and other aquatic habitat conservation efforts associated with the Preferred Alternative would also benefit salmonids in the vicinity. When considered with other salmon conservation and enhancement efforts being conducted by entities such as King County, the Salmon Recovery Funding Board, NOAA-Fisheries, WRIA planning groups, and other entities the localized benefits at the Maury Island site would produce a minor cumulative benefit for salmonids in the greater Puget Sound.

Under the Repeal the Reserve Alternative there would be a moderate probability of negligible adverse cumulative impacts related to plant and animal resources. Without a

management plan for the site, land use practices and DNR use authorizations would likely continue to contribute to non-point source pollution, which could impact aquatic vegetation, fish species, and other aquatic fauna. Such localized impacts would be contrary to the region-wide planning efforts of King County, Salmon Recovery Funding Board, NOAA-Fisheries, and other entities. However, as the Maury Island site is relatively small in comparison to the Puget Sound as a whole, these potential cumulative impacts would likely be minor.

The potential cumulative impacts of the No Action Alternative would be similar to those for the Preferred Alternative. However, without a management plan that defines a systemic and standardized method for protecting plant and animal resources at the Maury Island site, the likelihood of realizing the potential beneficial cumulative impacts would be reduced under Alternative 3.

5.5 Energy and Natural Resource Use

None of the action alternatives would result in any adverse cumulative impacts related to energy use or consumption.

The Preferred Alternative could result in beneficial impacts to natural resource use related to shellfish and forage fish harvest. The indirect benefits on aquatic species associated with the preferred alternative, through preservation and improvement of aquatic habitat, could increase harvest opportunities. The beneficial impact when considered in association with other agency efforts (i.e., WDFW) to improve harvest opportunities could lead to minor beneficial cumulative impacts related to use of these natural resources. However, as the Maury Island area is relatively small, the beneficial impact would likely be negligible.

Alternative 2 would have a low probability of negligibly contributing to adverse cumulative impacts on Puget Sound shellfish and forage harvest. Under this alternative there would be no efforts for DNR to work with King County and other agencies to reduce the potential adverse indirect effects of development on natural resource use in the area, such as the effect of fecal coliform or PSP on shellfish harvest and the clearing of aquatic vegetation impacting forage fish available for harvest. Therefore, these indirect impacts would likely continue to occur and possibly worsen, which would negligibly contribute to adverse cumulative impacts associated with human development that hamper efforts in the Puget Sound to improve natural resource harvest opportunities. However, as the Maury Island area is relatively small, the potential adverse cumulative impact would likely be negligible.

The potential cumulative impacts of Alternative 3 would be similar to those for the Preferred Alternative. However, without a management plan that defines a systemic and standardized method for maintaining natural resource uses at the Maury Island site, the likelihood of realizing the potential beneficial cumulative impacts would be reduced under Alternative 3.

5.6 Environmental Health

The Preferred Alternative could produce beneficial cumulative impacts related to environmental health when considered within the context of other efforts in the Puget Sound to improve environmental health, such as the efforts of the Puget Sound Action Team and King County.

The Repeal the Reserve Alternative would have a minor probability of negligibly contributing to adverse cumulative impacts on environmental health. Use authorizations would be issued in accordance with standard DNR regulations and policies and there would be no specific guidance to DNR land managers to ensure that use authorizations accounted for potential impacts on environmental health.

The potential cumulative impacts of the No Action Alternative would be similar to those for the Preferred Alternative. However, without a management plan that defines a systemic and standardized method for protecting environmental health at the Maury Island site, the likelihood of realizing the potential beneficial cumulative impacts would be reduced under Alternative 3.

5.7 Land and Shoreline Use

None of the proposed alternatives would be expected to contribute to either beneficial or adverse cumulative impacts on land and shoreline use.

5.8 Transportation

None of the proposed alternatives would be expected to contribute to either beneficial or adverse cumulative impacts on transportation.

5.9 Public Services and Utilities

None of the proposed alternatives would be expected to contribute to either beneficial or adverse cumulative impacts on public services and utilities.

6.0 Mitigating Actions

The DNR would undertake general actions under each of the alternatives that would mitigate for some or all of the impacts to the natural and built environments.

6.1 Alternative 1 (Preferred Alternative)

The Preferred Alternative would cause no negative impacts to the natural environment. There is potential, however, for the Preferred Alternative to cause negative impacts to the built environment. To mitigate these impacts, the DNR would undertake several actions:

- Work cooperatively with existing and future lessees to develop long-range plans that would identify milestones and timeframes for complying with the reserve criteria. Existing uses within the reserve shall not be required to meet all of the reserve criteria immediately. Attainment of the reserve criteria would be over time. The DNR would also seek outside funding sources to assist lessees with conservation efforts on their leasehold areas.
- Work cooperatively with adjacent landowners on a voluntary basis to address activities taking place adjacent to the reserve that may indirectly impact habitats and species within the reserve. Landowners would not be required by DNR to participate in these efforts. The DNR would also seek outside funding sources to assist interested landowners with conservation efforts on their properties.
- Work cooperatively with recreational user groups on a voluntary basis to address transient recreational activities taking place within the reserve that may impact habitats and species within the reserve. Recreational user groups would not be required by DNR to participate in these efforts. The DNR would also seek outside funding sources to assist recreational user groups with conservation efforts on their properties.

6.2 Alternative 2 (Repeal the Reserve)

Alternative 2 would cause negative impacts to the natural environment and some negative impacts to the built environment. To mitigate these impacts, the DNR would work within existing RCWs, WACs, and DNR internal guidance to avoid, minimize, and compensate for impacts on a project-by-project basis. In addition, the DNR would work with local, state, and federal regulators to address environmental impacts through the permitting process.

6.3 Alternative 3 (No Action)

Alternative 3 would not likely cause significant negative impacts to the natural environment. There is a potential, however, for Alternative 3 to cause negative impacts to the built environment. To mitigate these impacts, the DNR would work within existing RCWs, WACs, and the programmatic FEIS to avoid, minimize, and compensate for impacts on a project-by-project basis. The DNR would also attempt to provide areas outside of the reserve for activities that could not be authorized within the reserve.

7.0 Distribution

Notice of availability of this document on DNR's website (www.dnr.wa.gov) will be sent to all entities with jurisdiction and interest in the Maury Island site, such as local government planning departments (city and county), state and federal agencies, public port districts, leaseholders, selected environmental organizations, academia, industry representatives, selected Washington newspapers, affected Tribes, and interested public. A copy of the distribution list is included as Appendix N. In addition, two hard copies will be printed and submitted to Department of Ecology. Additional hard copies may be printed and made available upon request, by contacting the Department of Natural Resources, Aquatic Resources Division, as follows:

Department of Natural Resources – Aquatic Resources Program
1111 Washington St SE, P.O. Box 47027; Attn: David Palazzi
Olympia, WA 98504-7027
Phone: (360) 902-1069; e-mail: *david.palazzi@wadnr.gov*

or

SEPA Center
Department of Natural Resources
1111 Washington St. SE, PO Box 47027, Attention Jenifer Gitchell
Olympia, WA 98504-7027
Phone: (360) 902-1634; e-mail: SEPACenter@wadnr.gov

8.0 References

Anchor Environmental LLC. 2004. Marine Shoreline Inventory Report: WRIA 9. Prepared for Seattle Public Utilities: WRIA 9. Seattle, Washington.

Arnold, C.L., and C.J. Gibbons. 1996. Impervious surface coverage: The emergence of a key environmental indicator. Journal of the American Planning Association 62(2):243–258.

Battelle Marine Science Laboratory. 2003. Assessment of the euphotic zone depth at east Maury Island. Prepared for Glacier Northwest. Sequim, Washington.

Berry, H.D., J.R. Harper, T.F. Mumford Jr., B.E. Bookheim, A.T. Sewell, and L.J. Tamayo. 2001. The Washington State ShoreZone Inventory User's Manual. Report for Washington Department of Natural Resources, Aquatic Resources Division, Olympia, Washington.

Berry, H.D., A.T. Sewell, S. Wyllie-Echeverria, B.R. Reeves, T.F. Mumford, Jr., Skalski, R.C. Zimmerman, and J. Archer. 2003. Puget Sound submerged vegetation monitoring project: 2000 – 2002 monitoring report. Nearshore Habitat Program, Washington State Department of Natural Resources. Olympia, Washington.

Blau, S.F. 1975. Quartermaster Harbor Marine Park Study. Volume II, Report #4: Marine Biology. College of Forest Resources, University of Washington. Seattle, Washington.

Bloch, P., T. Dean, and J. White. 2002. Vashon and Maury Island rapid shoreline inventory. People For Puget Sound. Seattle, Washington.

Booth, D.B., and C.R. Jackson. 1997. Urbanization of aquatic systems: Degradation thresholds, stormwater detection, and the limits of mitigation. Journal of the American Water Resources Association 35(5):1077–1090.

Bradbury, A., B. Sizemore, D. Rothaus, and M. Ulrich. 2000. Stock assessment of subtidal geoduck clams (*Panopoa abrupta*) in Washington. Washington Department of Fish and Wildlife Marine Resources Unit. January 2000. Olympia, Washington. 59 pp.

Brennan, J. and K. Higgins. 2004. Salmonid Species Composition, Timing, Distribution, and Diet in Nearshore Marine Waters of WRIAs 8 and 9 in 2001-2002. Prepared for: Water Resources Inventory Area (WRIA) 9 Strategic Assessment, by: King County Water and Land Resources Division. Seattle, Washington.

Busby, P.J., T.C. Wainwright, G.J. Bryant, L.J. Lierheimer, R.S. Waples, F.W. Waknitz, and I.V. Lagomarsino. 1997. Status review of west coast steelhead from Washington, Idaho, Oregon, and California. NOAA Technical Memorandum NMFS-NWFSC-27. National Marine Fisheries Service Northwest Fisheries Science Center. Seattle, Washington.

Carlton, J.T. 1979. History, Biogeography, and Ecology of the Introduced Marine Invertebrates of the Pacific Coast of North America. Ph.D. thesis, University of California, Davis, 904 pp.

Cohen, A.N. and J.T. Carlton. 1995. Nonindigenous Aquatic Species In a United States Estuary: A Case Study of the San Francisco Bay and Delta. United States Fish and Wildlife Service and The National Sea Grant College Program – Connecticut Sea Grant (NOAA Grant # NA36RG0467).

Cohen, A. N., H.K. Berry, M. J. Wonham, J. Cordell, D. Milne, D. Secord, B. Bingham, B. Bookheim, J. W. Chapman, L. H. Harris, A. Kohn, K. Li, C. E. Mills, T. Mumford, V. Radishevsky, and A. Sewell. 2000. Report of the Washington State Exotics Expedition 2000: A Rapid Assessment Survey of Exotic Species in Elliot Bay, Totten/Eld Inlets and Willapa Bay. Washington State Department of Natural Resources, Olympia WA.

Cramer, S.P. J. Norris, P.R. Mundy, G. Grette, K.P. O'Neal, J.S. Hogle, C. Steward, and P. Bahls. 1999. Status of Chinook salmon and their habitat in Puget Sound. Volume 2 Final Report. Prepared for Coalition of Puget Sound Businesses. S.P. Cramer and Associates. Gresham, Oregon.

Crecelius, E.A., D.L. Woodruff, and M.S. Myers. 1989. 1988 reconnaissance survey of environmental conditions in 13 Puget Sound locations. Prepared for Battelle Ocean Sciences. Contract No. 68-03-3319. 88 pp.

Cullinan, T. 2001. Important bird areas of Washington. Audubon Washington. Olympia, Washington.

Determan, T. 2003a. Atlas of fecal coliform pollution in Puget Sound: a report for the Puget Sound Ambient Monitoring Program. Washington Department of Health, Olympia, Washington.

Determan, T. 2003b. Paralytic shellfish poisoning (PSP) patterns in Puget Sound shellfish in 2001: a report for the Puget Sound Ambient Monitoring Program. Washington Department of Health, Olympia, Washington.

Eisenberg, T, S. Gohrman, D Heimer, D Kolby, S Moreno, K Murphy, B Reeves, S Riggs, B Rogers, J Phell, and S Wirth. 2001. 2001 Spartina Management Plan for North Puget Sound. Washington Department of Agriculture. 32 pp.

EVS Environment Consultants. 2000. Maury Island gravel mine impact study: nearshore impact assessment. Prepared for Pacific Groundwater Group. Seattle, Washington. 109 pp.

Faulkner, D. A. 1987. The Effect of a Major Emitter on the Rain Chemistry of Southwestern British Columbia—a Preliminary Analysis Part I. Report No. PAES 87-1, Atmospheric Environment Service, Pacific Region, Environment Canada, Vancouver.

Geraci, J.R., D.M. Anderson, R.J. Timperi, D.J. St. Aubin, G.A. Early, J.H. Prescott, and C.A. Mayo. 1989. Humpback whales (*Megaptera novaeangliae*) fatally poisoned by dinoflagellate toxin. Canadian Journal of Fisheries and Aquatic Sciences 46:1895-1898.

Gibson, G.R., M.L. Bowman, J. Gerritsen, and B.D. Snyder. 2000. Estuarine and Coastal Marine Waters: Bioassessment and Biocriteria Technical Guidance. EPA 822-B-00-024. U.S. Environmental Protection Agency, Office of Water, Washington, DC.

Glass, G.L. 2000. Vashon/Maury Island Soil Study: 1999-2000. Environmental Health Division Public Health – Seattle & King County. Seattle, Washington.

Goetz, F. 1989. Biology of bull trout (*Salvelinus confluentus*) a literature review. Willamette National Forest. Eugene, Oregon.

Goodwin, C.L. and B.C. Pease. 1991. Geoduck (*Panopea abrupta*), size, density, and quality as related to various environmental parameters in Puget Sound, Washington. Journal of Shellfish Research 10:65-77.

Global Program of Action (GPA). 2001. Global programme of action for the protection of the marine environment from land based activities. United Nations Environment Programme. Available at: http://pops.gpa.unep.org/11aldi.htm

Haulman, B. 2002. Vashon-Maury timeline. Vashon: The Natural and Human History of an Island. Work in progress. Available at: http://www.vashonhistory.com/vashontimeline.htm

Healey, M.C. 1991. The life history of Chinook salmon (*Onchorhynchus tshawytscha)*. *In* C. Groot and L. Margolis (eds.), Pacific Salmon Life Histories, p. 311-393. University of B.C. Press, Vancouver, B.C.

Hoffmann, A., A. Bradbury, and C.L. Goodwin. 2000. Modeling geoduck, *Panopea abrupta* population dynamics; I Growth. Journal of Shellfish Research 19:57-62.

Johnson, O.W., W.S. Grant, R.G. Kope, K. Neely, F.W. Waknitz, and R.S. Waples. 1997. Status review of chum salmon from Washington, Oregon, and California. NOAA Technical Memorandum NMFS-NWFSC-32. Northwest Fisheries Science Center. Seattle, Washington.

Johnson, D. 2000. 2000 report to the Legislature – Status of high and significant hazard dams in Washington with Safety deficiencies: Washington State Department of Ecology report # 00-11-011, [Accessed May 21, 2002 at www.ecy.wa.gov/biblio/0011011.html].

Joseph, M (ed.). 1996. Digging for Clues on Vashon Island. A and S Perspectives Newsletter. University of Washington College of Arts and Sciences 8(1):12-13.

Kerwin, J. and T. S. Nelson (Eds.). 2000. Habitat Limiting Factors and Reconnaissance Assessment Report, Green/Duwamish and Central Puget Sound Watersheds (WRIA 9 and Vashon Island). Washington Conservation Commission and the King County Department of Natural Resources.

King County. 2000. Final environmental impact statement Maury Island Glacier Northwest gravel mine. King County Department of Development and Environmental Services. June 2000.

King County. 2002. King County comprehensive plan 2000; updated through 2002. King County Department of Development and Environmental Services. Available at: http://www.metrokc.gov/ddes/compplan/2000/.

King County. 2003. 2004 amendments to King County comprehensive plan 2000 public review draft. King County Department of Development and Environmental Services. Available at: http://www.metrokc.gov/ddes/compplan/2004/PubRevDraft/index.htm.

King County. 2004. Vashon-Maury Island rapid rural reconnaissance draft report. King County Department of Natural Resources and Parks Water and Land Resources Division. January 2004.

Kirschenbaum, M. 1996. Western grebe (*Aechmophorus occidentalis)*. National Park Service, Chihuahuan Desert. July 1996.

Kvitek, R.G., and M.K. Beitler, 1988. A case for sequestering of paralytic shellfish toxins as a chemical defense. Journal of Shellfish Research 7(4): 629-636.

Landahl, J.T. 1985. Patterns of Distribution of *Mytilus edulis*, Their Causes, And Their Effects on The Co-Occurring Fauna of A Sand-Gravel Beach. Ph.D. Thesis, University of Washington. Seattle, Washington.

Lanzer, E.L. 1999. Aquatic Land Area Estimation 1999. Aquatic Resources Division, Washington State Department of Natural Resources, Olympia, WA.

Larkin, M.G. 1975. Quartermaster Harbor Marine Park Study Volume 11: History of Vashon-Maury Island. College of Forest Resources, University of Washington.

Lavelle, J. W., G. J. Massoth, and E. A. Crecelius. 1986. Accumulation rates of recent sediments in Puget Sound, Washington. Marine Geology 72:59-70.

Lemberg, N.A. 1997. 1996 Forage Fish Stock Status Report. Washington Department of Fish and Wildlife, Fish Management Program. Report No. 98-1.

Light, J. T. 1987. Coastwide abundance of North American steelhead trout. Fisheries Research Institute Report FRI-UW-8710. Univ. Washington, Seattle, 18 p.

Long, E.R., M. Dutch, S. Aasen, K. Welch, and M.J. Hameedi. 2003. Chemical contamination, acute toxicity in laboratory tests, and benthic impacts in sediments of Puget Sound: a summary of results of the joint 1997-1999 Ecology/NOAA survey. Washington State Department of Ecology and National Oceanic and Atmospheric Administration. October 2003.

Lynn, H.W. 1975. Lieutenant Maury's Island and the Quartermaster's Harbor. Beachcomber Press. Vashon, Washington.

Malins, D.C., N.L. Polissar, and S.J. Gunselman. 1997. Infrared spectral models demonstrate that exposure to environmental chemicals leads to new forms of DNA. Proceedings of National Academy of Science, 94: 3611-3615.

Marine Mammal Center. 2000. Harbor seal *Phoca vitulina*. The Marine Mammal Center. San Francisco, California. 2 pp.

McCrae, J. 1994. Oregon developmental species Pacific herring (*Clupea pallasi*). Oregon Department of Fish and Wildlife. 5 pp.

Menashe, E. 2001. Bio-Structural Erosion Control: Incorporating Vegetation Into Engineering Designs to Protect Puget Sound Shorelines. Proceedings of the Puget Sound Research Conference – 2001. http://www.psat.wa.gov/Publications/01_proceedings/sessions/oral/4b_menas.pdf

Miller, B. S., and S. F. Borton. 1980. Geographical distribution of Puget Sound fishes: maps and data source sheets. Volumes 1-3. Fish. Res. Inst., University of Washington, Seattle, WA.

Mills, C. E., A. N. Cohen, H. K. Berry et al. (in press). The 1998 Puget Sound Expedition: a rapid assessment survey for nonindigenous species in the shallow waters of Puget Sound. Proc. First Nat'l Conf. On Marine Bioinvasions, Jan. 24-27, 1999, Cambridge MA.

Mumford, T., H. Berry, and A. Sewell. 2000. Ecological evaluation of proposed Maury Island Reserve. Memorandum to M.V. Peeler, C. Turley, and J. Udelhoven of Washington Department of Natural Resources. November 9, 2000.

Myers, J.M., R.G. Kope, G.J. Bryant, D. Teel, L.J. Lierheimer, T.C. Wainwright, W.S. Grant, F.W. Waknitz, K. Neely, S.T. Lindley, and R.S. Waples. 1998. Status review of Chinook salmon from Washington, Oregon, Idaho, and California. U.S. Dept. Commerce, NOAA Technical Memo. NMFS-NWFSC-35. 443 pp.

National Marine Fisheries Service (NMFS). 2003. Draft Environmental Assessment Puget Sound Chinook Harvest Resource Management Plan. Prepared by NMFS with assistance from Puget Sound Treaty Tribes and WDFW. Seattle, WA. Draft of May, 2003.

Nearshore Habitat Program. 2001. The Washington State ShoreZone Inventory. Washington State Department of Natural Resources, Olympia, WA.

Newton, J.A., S.L. Albertson, K. Van Voorhis, C. Maloy, and E. Siegel. 2002. Washington State Marine Water Quality, 1998 through 2000. Washington Department of Ecology Publication No. 02-03-056. Olympia, Washington.

Northern Technical Services (Nortec). 1984. Marine environmental impact assessment for proposed facility improvements in inner Quartermaster Harbor. Prepared for Quartermaster Harbor Marine Associates and Quartermaster Yacht Club. April 1984.

Nybakken, J. W. 1997. Marine Biology: an ecological approach. Addison-Wesley Educational Publishers. Reading, MA.

Osborne, R.W. 1999. A Historical Ecology of Salish Sea 'Resident' Killer Whales (*Orcinus orca*): with Implications for Management. Doctoral Dissertation, Department of Geography, University of Victoria, B.C. 262 pp.

Pacific States Marine Fisheries Commission. 2002. Regional mark information service December 2002 database search of hatchery release information by the William Douglas Company, Seattle, Washington.

Palsson, W.A. 1998. Monitoring the response of rockfishes to protected areas. Marine harvest refugia for west coast rockfish: a workshop. August 1998. Pacific Grove, CA. NOAA Technical Memorandum NOAA-TM-NMFS-SWFSC-255.

Pease, M. 2000. *Aechmophorus occidentalis* Western Grebe. University of Michigan Animal Diversity Web. May 2000.

Puget Sound Clean Air Agency. 2004. Regional air monitoring network data. Accessed through the Puget Sound Clean Air Agency web page on January 5, 2004. http://www.pscleanair.org/airq/datareq.aspx

Puget Sound Water Quality Action Team. 2002. Puget Sound's Health 2002 – Status and Trends of Key Indicators of Puget Sound's Health. Olympia, Washington

Quinn, T., and R. Milner. 1999. Great blue heron (*Ardea herodias*). *In* E. M. Larsen and N. Nordstrom, editors. Management Recommendations for Washington's Priority Species, Volume IV: Birds. Available at: http://www.wa.gov/wdfw/hab/phs/vol4/gbheron.htm

Raleigh, R.F., W.J. Miller, and P.C. Nelson. 1986. Habitat suitability index models and instream flow suitability curves: Chinook salmon. Report # Rep. 82(10.122). U.S Fish and Wildlife Service.

Schueler, T.R. 1994. The importance of imperviousness. Watershed Protection Techniques 1(3):100–111. Schueler. T.R. and H.K. Holland. Eds. 2000. The practice of watershed protection. Ellicott City, MD: Center for Watershed Protection.

Schwartz, M.L., M. Chrzastowski, B. Harp, and B.E. Taggart. 1991. Net shore-drift in Washington State: Volume 3, Central Puget Sound Region. Shorelands and Coastal Zone Management Program, Washington Department of Ecology. June 1991. Olympia, Washington.

Scott, W.B. and E.J. Crossman. 1973. Freshwater fishes of Canada. Fisheries Research Board of Canada. Bulletin 184.

Simenstad, C.A., J.R. Cordell, R.C. Wissmar, K.L. Fresh, S. Schroder, M. Carr, and M. Berg. 1988. Assemblages structure, microhabitat distribution, and food web linkages of epibenthic crustaceans in Padilla Bay National Estuarine Research Reserve, Washington. NOAA Tech. Rep. Ser. OCRM/MEMD, FRI-UW-8813, Fish. Res. Inst., University of Washington. Seattle, Washington. 60 pp.

Sizemore, B. and M. Ulrich. 2002. State of Washington 2002 Geoduck Atlas – Atlas of Major Geoduck Tracts of Puget Sound. WA Department of Fish and Wildlife, Fish Program. FPA02-05

Stalmaster, M.V. 1987. The Bald Eagle. Universe Books. New York, New York. 227pp.

Stinson, D.W., J.W. Watson, and K.R. McAllister. 2001. Washington State status report for the bald eagle. Washington Department of Fish and Wildlife. Olympia, Washington. 92pp.

Thom, R.M., L.D. Antrim, A.B. Borde, W.W. Gardiner, D.K. Shreffler, P.G. Farley, J.G. Norris, S.W. Echverria, and T.P. McKenzie. 1998. Puget Sound's eelgrass meadows: Factors contributing to depth distribution and spatial patchiness. *In*: Proceedings of Puget Sound Research. 1998. pp. 363-370. Puget Sound Water Quality Action Team, Olympia, Washington.

Turnbeaugh. 1975. Quartermaster Harbor Marine Park Study. Volume II: Hydrology. College of Forest Resources, University of Washington. Seattle, Washington.

Van Olinda, O.S. 1935. History of Vashon-Maury Islands. Vashon Island News-Record. Vashon Island, Washington.

Washington Department of Ecology (Ecology), Water Quality Program. 1998. 1998 303d List of Impaired and Threatened Water Bodies. [Accessed on May 21, 2002 at http://www.ecy.wa.gov/programs/wq/303d/1998/1998-index.html#background

Washington Department of Ecology (Ecology), Toxics Cleanup Program. 2003. Sediment Cleanup Status Report. Publication No., 03-090-086.

Washington Department of Ecology (Ecology), Water Quality Program. 2004. Proposed 2002/2004 water quality assessment (list). Draft available at: www.ecy.wa.gov/programs/wq/303d/2002/2002_list.html

Washington Department of Fish and Wildlife (WDFW). 2004. Unpublished herring spawning biomass estimates by stock and region, 1994-2003. Received by Mark Mauren of DNR on January 20, 2004.

Washington Department of Fish and Wildlife (WDFW). 2003a. Puget Sound chum salmon run size and escapement data. Downloaded from Washington Department of Fish and Wildlife web page December 17, 2003. Available at: http://www.wdfw.wa.gov/fish/chum/chum-5e.htm.

Washington Department of Fish and Wildlife (WDFW). 2003b. South Sound commercial geoduck tract index maps. Downloaded from WDFW web page on December 18, 2003. Available at: http://wdfw.wa.gov/fish/shelfish/geoduck/south1.htm

Washington Department of Fish and Wildlife (WDFW). 2003c. Species of concern in Washington State. Downloaded on February 6, 2004 from the WDFW Species of Concern web page: http://wdfw.wa.gov/wlm/diversty/soc/soc.htm. Last updated May, 2003.

Washington Department of Fish and Wildlife (WDFW). 2000. Critical spawning habitat for herring, surf smelt, sand lance, and rock sole in Puget Sound, Washington. Washington Department of Fish and Wildlife Fish Program. March 2000.

Washington Department of Fish and Wildlife (WDFW). 1998. Salmonid Stock Inventory. Appendix Bull Trout and Dolly Varden. Olympia, WA. 437 pp.

Washington Department of Fish and Wildlife (WDFW). 1997. Forage Fish Web Page. http://wdfw.wa.gov/fish/forage/forage.htm

Washington Department of Fisheries, Washington Department of Wildlife, and Western Washington Treaty Indian Tribes. 1993. 1992 Washington State salmon and steelhead stock inventory. Washington Department of Fish and Wildlife, Olympia Washington. 212 pages plus 5 regional volumes.

Washington Department of Health (WDOH). 2004. Commercial growing area map search. Environmental Health Programs Food Safety and Shellfish Programs. Downloaded on February 4, 2004. Available at: www.doh.wa.gov/gis/growingareas.htm

Washington Department of Natural Resources (DNR). 2004. Draft Maury Island Environmental Aquatic Reserve Management Plan. Aquatic Reserves Program. July 13, 2004.

Washington Department of Natural Resources (DNR). 2002. Non-project final environmental impact statement aquatic reserves program guidance. Aquatic Resources Program. September 6, 2002. 168pp.

Washington Department of Natural Resources (DNR). 2001a. Final supplemental environmental impact statement (SEIS): State of Washington commercial geoduck fishery. Aquatic Resources Division. May 23, 2001. 135pp.

Washington Department of Natural Resources (DNR). 2001b. The State of Washington commercial geoduck fishery management plan. Aquatic Resources Division. May 23, 2001. 18pp.

Watson, J.W., M.G. Garrett, and R.G. Anthony. 1991. Foraging ecology of bald eagles in the Columbia River estuary. Journal of Wildlife Management 55(3):492-499.

Weitkamp, L.A., T.C. Wainwright, G.J. Bryant, G.B. Milner, D.J. Teel, R.G. Kope, and R.S. Waples. 1995. Status review of coho salmon from Washington, Oregon, and California. NOAA Technical Memorandum NMFS-NWFSC-24. National Marine Fisheries Service Northwest Fisheries Science Center. Seattle, Washington.

Williams, G. D. and R. M. Thom. 2001. Marine and Shoreline Modification Issues. Washington State Department of Fish and Wildlife, Aquatic Habitat Guidelines.

Williams, G.D., R.M. Thom, J.E. Starkes, J.S. Brennan (Ed.), J. P. Houghton, D. Woodruff, P.L. Striplin, M. Miller, M. Pedersen, A. Skillman, R. Kropp, A. Borde, C. Freeland, K. McArthur, V. Fagerness, S. Blanton, and L. Blackmore. 2001. Reconnaissance Assessment of the State of the Nearshore Ecosystem: Eastern Shore of Central Puget Sound, Including Vashon and Maury Islands (WRIAs 8 and 9). King County Department of Natural Resources, Seattle, WA.

Willsie, D. 2003. Supplemental bird data for important bird areas in Washington nomination for Quartermaster Harbor, Vashon-Maury Island. Audubon Washington.

Wydoski, R. S. and R. L. Whitney. 2003. Inland Fishes of Washington. Second Edition. American Fisheries Society and University of Washington Press. 322pp.